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THE
REPERTORY
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ARTS, MANUFACTURES,
AND
AGRICULTURE.

No. CCLIX. SECOND SERIES. Dec. 1823.

*Specification of the Patent granted to JOHN BARTON,
of Tufton-street, Westminster, in the County of Middle-
sex, Engineer; for various Improvements in the Con-
struction and Application of Steam-Engines.*

Dated November 1, 1813.

With a Plate.

TO all to whom these presents shall come, &c.
Now KNOW YE, that in compliance with the said pro-
viso, I the said John Barton do hereby declare that the
application of my said improvements are as follows:—
The principle of my patent is in saving the heat of
fires which is generally suffered to escape useless, to
raise steam; for which purpose I apply boilers or other
proper vessels containing water, in the most suitable and
convenient place, where the heat can act on with power;
which steam, when raised, the most ready method must
be taken to connect with the steam-engine boiler. The
high pressure I prefer, as with that I gain another great
advantage by the steam; after it has done its work in the
engine, and has passed the cock, I discharge it in vessels

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B

having

having false bottoms and sides, by pipes or other methods, being properly secured from the atmosphere by close covers and casing, with which I can dry or heat many things in less time, and with less expense and danger, than by the immediate application of fire to the vessel.

I fix a boiler which may have a flue through it to take the flame and heat from the cupola to raise steam (which is done quick with the blast which is necessary to melt the iron); to this I connect another boiler as close as I conveniently can, to which the cylinder and other working parts of the engine is connected, with a force-pump to supply water as it will waste by evaporation.

Furnaces, forges, ovens, kilns, glass-houses, and almost all great heats, may be advantageously employed to raise steam for drying or heating, or to work steam-engines, and afterwards will go further for drying, boiling, heating, &c. if properly applied, than any way the same fuel can be used. The principal businesses I know of, in which steam can be advantageously employed, is maltsters, dyers, distillers, brewers, sugar-houses, sugar-plantations, hop-drying, salt-works, tallow-melters, powder-drying, or any inflammatory business where drying or boiling is required; or it is particularly well adapted for warming manufactories, drying-houses, hot-houses, or any houses or buildings whatever, for which it can be applied, as there is no fear of fire or explosion. The chief advantage under my patent is doing two or three works by the heat originating from one fire. By this explanation, the general outlines and various applications of my patent may be understood, and applied by any intelligent engineer, with the assistance of a practical workman understanding the business to which it is applied. I claim some improvement in the steam-engine,—I use the cock
for

for reversing the steam with two sides cut out, by which I can reverse the steam by turning the cock about one-sixth round, so the steam on the piston is changed much quicker. I likewise use the piston very short, and I have holes cast or drilled nearly through the piston between the screws which tighten the cap, to put in tallow when I pack the engine; this tallow escapes by small holes drilled horizontally into the holes where the tallow is, so it keeps the packing greasy, and will wear much longer, and work much better, than the common way.

The method I use for raising steam from gentlemen's fires is, to have a hollow tube pass through the fire, in which water is always supplied by the engine or other boiler, to which it must be connected in a proper manner, so as to be removed at pleasure; this will be found a cheap way of warming the house, as it will likewise work a steam-engine sufficient to supply water, &c. for a large house, which the Patentee makes on a cheap and simple plan; and he is enabled to drain fen land cheaper than any plan at present practised.

The annexed plan shews a cupola A (Plate I.), for casting, with boiler B over, to raise steam, with steam-engine C, and likewise eight cisterns for heating or drying, &c., all working from one fire in the furnace A.

In witness whereof, &c.

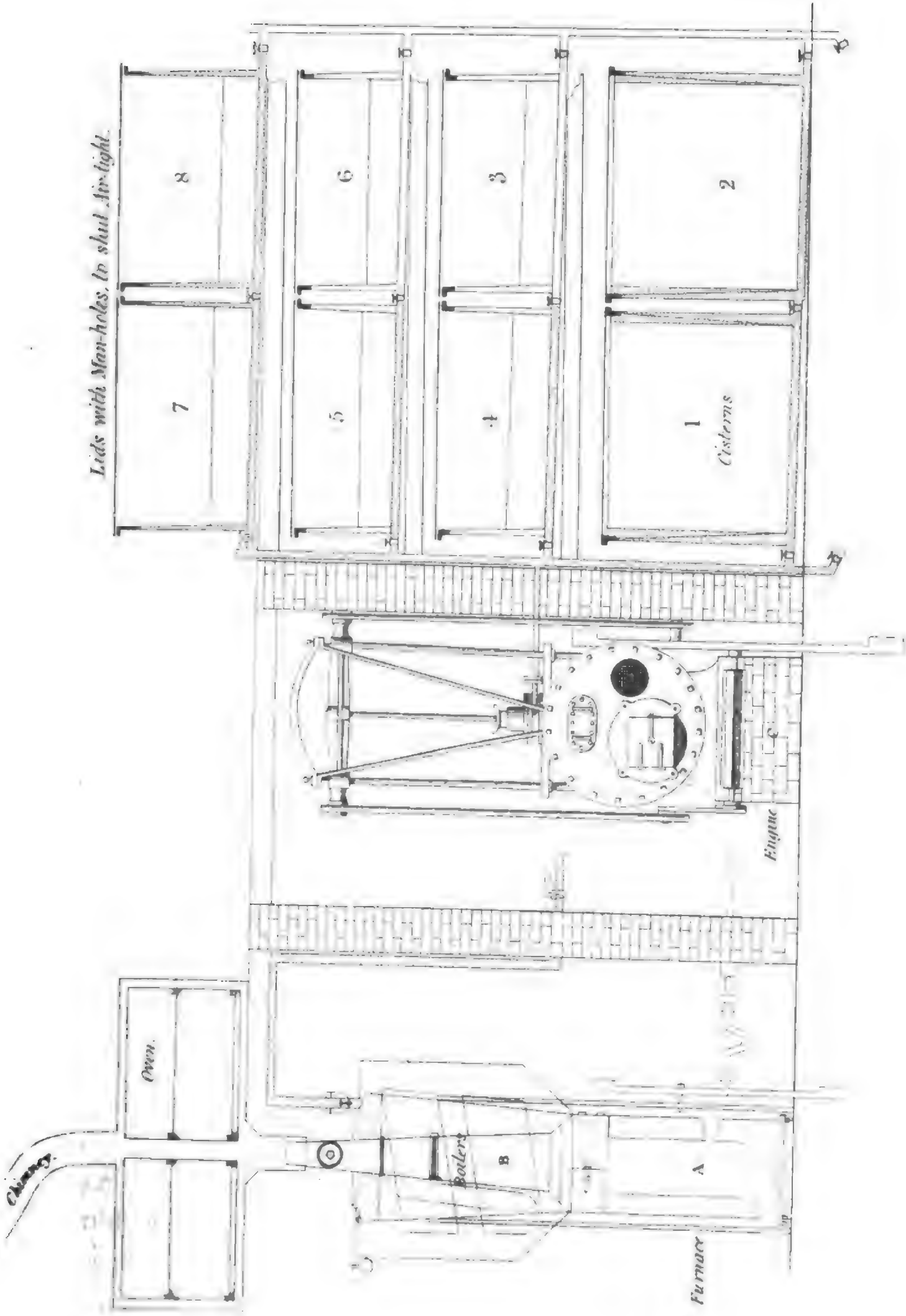
OBSERVATIONS BY THE PATENTEE.

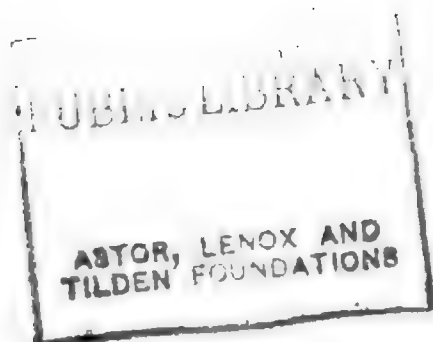
One of the principal objects of this patent is the economising of fuel, by applying it to the greatest advantage in heating, boiling, drying, evaporating, &c.

I have used the cupola, as shewn in the drawing, with the boiler suspended, the furnace was found to perform as conveniently as if without it, and when in full operation,
raised

4 *Patent for certain Improvements in Steam-Engines.*

raised steam above sufficient to work the engine in a more effectual manner than by the common mode. The steam is afterwards applied to the several cisterns, boilers, or vessels, from which I exclude as much as possible (when it can be advantageously done) the atmospheric air, and produce a vacuum. The said cisterns, boilers, or vessels are connected by pipes and cocks, or other convenient and suitable methods to condense or draw off the vapour. I then open a communication from the hot to the cold vessel, by which means I bring the latter to a forward state of heat, at the same time that the vacuum of the former is partly effected; recourse must be had to the main descending water-pipe, shown on the right of the pans, by opening a communication from the cistern or vessel from which you wish to draw off the vapour, in order to complete the vacuum. This will be found a most beneficial method of boiling and manufacturing many articles, such as sugar, or any commodities that require high temperature to bring them to a boiling point, as the ebullition is brought about at a much lower degree of heat, a considerable saving is effected in time and expense, the quality of the article is rendered superior, and there is no danger whatever of injury in the process. The principle has been applied with important advantage to a very considerable extent. The lower cisterns or pans are shewn with double covers, and the inside plates or cases, represented by the inner lines in the sides and tops, are perforated with small holes designed for the vapour to pass through, and to prevent the goods being drawn out by the vacuum and boiling. The pipe for conveying off the vapour only enters the top cover. The various deep and thick flanges at the tops of the cisterns or pans are intended to connect the several pipes, cocks, &c. that may be required to be applied for the various purposes





poses and applications of these vessels, as well as to strengthen them when it is necessary. The pans can be made of any strong figure, but an intelligent engineer, with the assistance of a practical person understanding the nature of the business to which these improvements are applied, will readily perceive and adopt the best form and shape without any difficulty whatever.

The late Lord Stanhope, Mr. Robertson Buchanan, of Glasgow, the author of a work on Steam and Heat, and other mechanical men, saw the apparatus in action, and highly approved of my application and views on the economy of heat and steam.

Other valuable modifications of this invention have been suggested and applied, an account of which I will lay before the public at an early period.

Specification of the Patent granted to SAMUEL ROBINSON, of Leeds, in the County of York, Cloth-dresser: for certain Improvements on a Machine for shearing and cropping Woollen Cloth. Dated March 21, 1822.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Samuel Robinson do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawing hereunto annexed, and the following description thereof; that is to say: My improvement on a machine for dressing and cropping woollen cloth consists of a frame supporting a travelling carriage, with cutters moved by bands and wheels connected to a steam-engine, or from any first mover.

Fig.

Fig. 1 (Plate II.) is the improved machine shewn in perspective in complete action.

Fig. 2 is a frame and shafts divested of the carriage and board, taken on the opposite side to the view shewn in Fig. 1.

Fig. 3 is the underside of the carriage, shewing the situation of the ledger-blades and of the cutters.

In Fig. 1, W is a drum-wheel turned by the moving power, from which drum a band passes to a pulley X, upon the shaft S, which gives motion to the machine; E is a large pulley upon the same shaft S, from which an endless cord passes to the small pulley F, at the reverse end of the machine, which embraces the carriage pulleys Y Y; and by the revolution of the shaft S, give motion to the cutter rollers C C. In Fig. 1, one of the covers J is raised for the purpose of shewing the roller cutter, and B shews a contrivance by a screw and slot, which is the manner in which the frame is jointed together, so as to be capable of adjustment to the various breadths of cloth. A is a board padded with a pair of blankets (this number, however, may be varied), and covered with brown Holland cloth; this board rests upon the frame *a* in Fig. 2, shewn also in Fig. 1, and is fixed by eight screws passing through loops *z z*, on the edge of the frame; B is a cast-iron carriage sliding over the board, with the ledger blades and rollers C C, round which the cutters are coiled; these cutters and ledger-blades, when in operation, rest upon the board A over which the cloth is stretched from list to list for shearing. The carriage in returning is raised from the board A, upon the sliders H, which are lifted up by the inclined plane of the sliders *p p*, Fig. 2, pressing under the shafts O, when the carriage returns upon four pullies V, V, V, V, as seen in Fig. 3. D are the hooks with hinged ribs, by which the cloth

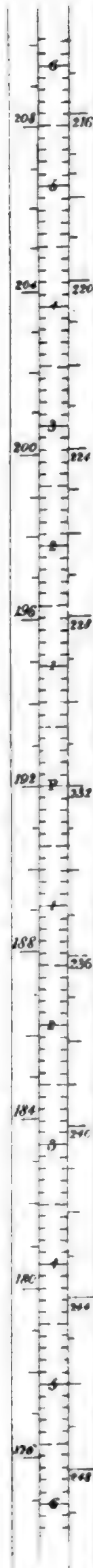
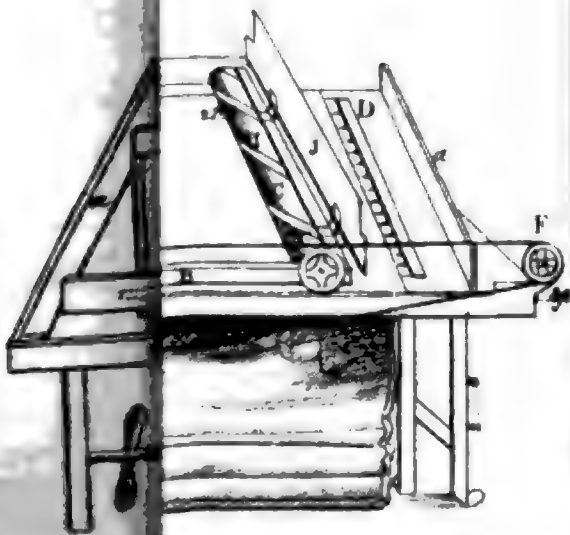
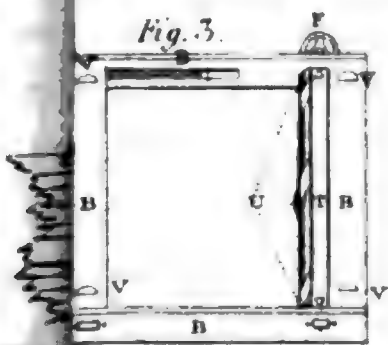
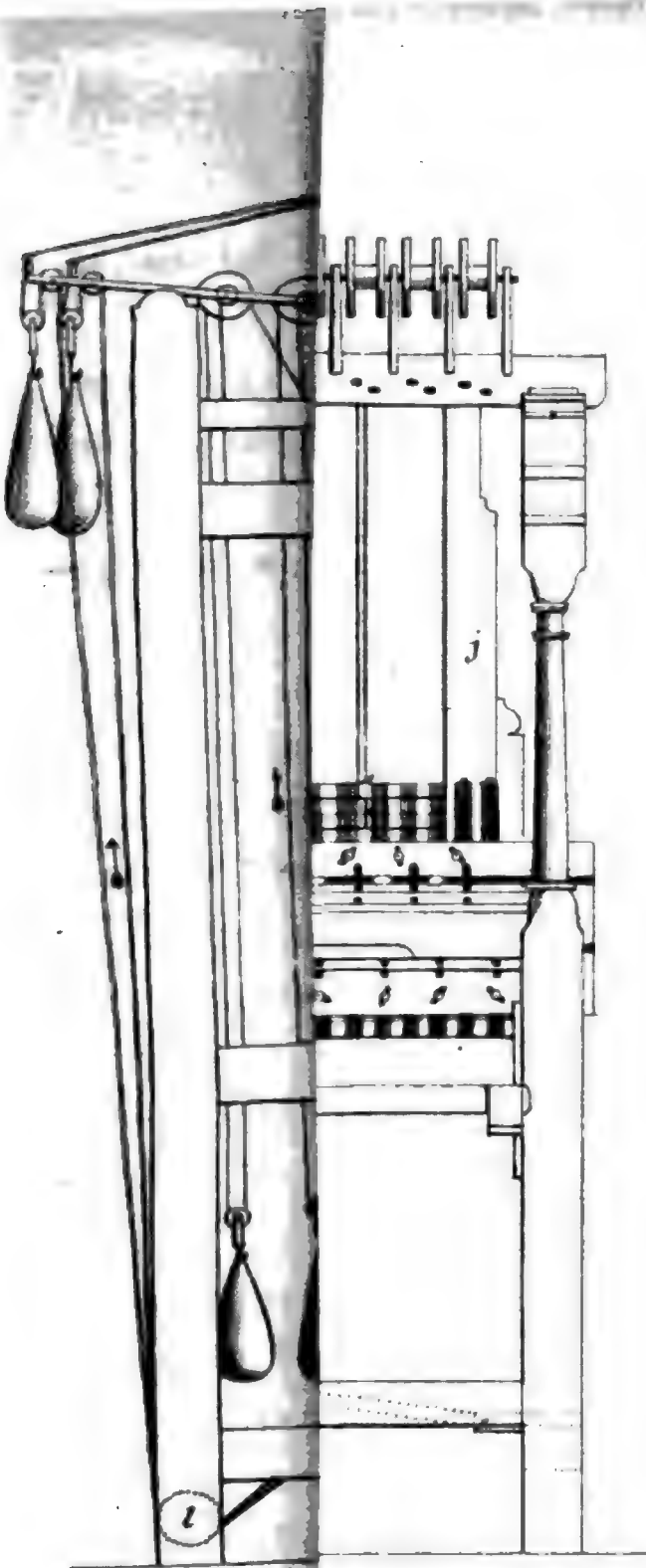


Fig. 6.

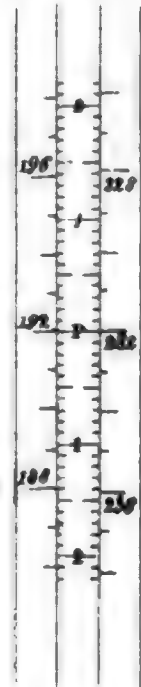
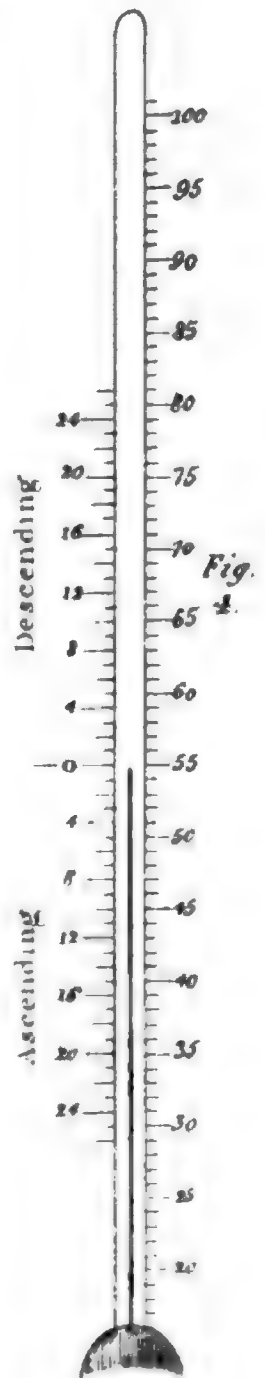


Fig. 5.





cloth is distended and fastened by the list on one side to the frame, and on the other side by the list to the lever-shaft Q, with straps and screws to accommodate the breadth of the various sorts of cloth. On the shaft S a worm is placed, into which worm a toothed wheel *b* works; this wheel is upon a transverse shaft M: the pivots of which shaft rest in the frame *a* at the one end, and in the board A at the other end. A pulley *d* is placed against the side of the frame H in an inclined position, over which a cord K from the carriage passes; this cord is attached to the shaft M, and as the shaft revolves coils the cord round it, and hence draws the carriage forwards over the cloth by a slow movement. I is a lever fixed to the shaft Q, Fig. 2, which is shewn detached at Fig. 4; L L are two slides fixed to the slides H and the frame *a*, for throwing the strap on to the loose pulley; Q is a shaft with four levers seen detached at Fig. 4, the large one I, it is to be worked by, the two smaller ones are to fasten the hooks D, Fig. 1, and the slips P in Fig. 2, the smallest is to throw the shaft M in and out of gear; R is a long roller to draw the cloth over the board; T T are the ledger-blades, fastened by an adjusting screw at each end, as described in Fig. 6; U are the steel plates or cutters, coiled round the copper rollers, with a plate at each end screwed to the roller.

Fig. 5 is one of the rollers detached with the cutters coiled round it, and pulley at its end.

Fig. 6 are the ledger-blades, and Fig. 7 the plate of steel to form the cutter before it is coiled round the roller.

In witness whereof, &c.

Specification

Specification of the Patent granted to WILLIAM GOODMAN, of the City of Coventry and the Borough of Warwick, Hatter; for certain Improvements in Looms.

Dated September 27, 1822.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, in compliance with the said proviso, I the said William Goodman do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawing hereunto annexed, and the following description thereof; that is to say: My invention of certain improvements in looms, apply to that description of looms usually employed for the weaving of narrow articles (commonly called Dutch engine-looms), and consist principally in a novel arrangement of the shuttles and slays in the batten. The general appearance of the loom, with its improvements, will be seen in the drawings of which,

Fig. 1 (Plate II.) is an end view, shewing the disposition of the warps for two sets of shuttles.

Fig. 2 is a front view of the same loom, a portion of the breast piece being removed for the purpose of seeing the front of the batten, and the two ranges of shuttles. The construction of the batten with the slays and the shuttles, are in every respect the same as usually employed in engine-looms, except, that in my improved loom there are three shuttle-boards, forming two distinct races for the reception of two sets of shuttles; the warp or slay-spaces of the upper range intervening between the spaces of the lower range.

Fig.

Fig. 3 is a representation of part of the back of the batten, shewing the situation and manner of fixing the slays, and the construction of the driver. The front of the batten consists of three planks *a, a, a*, as seen in Figs. 1 and 2, one of which planks is affixed to the top-rail *b* of the batten, by means of a series of slay-screws; the bottom plank is affixed to the lower-rail *c* of the batten in a similar manner; and the middle plank is secured to the slay-rail *d*, either by ordinary wood-screws or by pins with shoulders, so as to leave a space between the back of the plank and the slay-rail for the action of the driver. The back view of the batten at Fig. 3, shews the top and bottom rails *b* and *c*, with the clips of the slay-screws; and the slay-rail *d*, to which the middle plank is attached. This slay-rail is affixed to the batten by means of the two swords *j j*, which are secured to it, and also by iron straps near the middle, extending from the top to the bottom rails. On the upper and lower surfaces of this rail *d*, there are shallow mortices to receive the ends of the slays *e, e, e*; and the reverse ends of the slays rest in rebates in the top and bottom rails, and are secured by the clips of the slay-screws. The shuttles made after the ordinary construction are introduced in the races between the shuttle-boards, and the horizontal action of the driver *f* impels the shuttles to and fro through the warps. The driver *f*, which in the ordinary engine-looms is formed like a ladder, in my improved loom must be constructed with teeth extending from the top and bottom rail of its frame; and which teeth may or may not (at the option of the workman) be united together in the middle by diagonal pieces, for the purpose of giving the teeth greater stability. The general operation of the loom will be understood by the follow-

ing description: *g g* are the rollers upon which a sufficient quantity of the material is wound to form two warps; from hence the threads pass in the ordinary manner to the back-slays *h h*, then under the warp-rollers *i i*, to the leashes *k k*, knotted to arrange with each set of warps, through which each distinct warp is passed to its respective slay. Near this point the shuttles pass to and fro, and, by the interweaving of their weft-threads, produce the work; which is driven by the beating up of the batten, and drawn off through the top and bottom spaces *m m*, and *n n*, in the breast-piece; it then proceeds to the work roll or rollers *l*, and thence to the back castle, where it is distended by the weighted bags and pullies. From these pullies it is carried over the top castle *o*, and through the apertures *p p* in the work castle, where it is secured by a wedge to keep it from running back; and as the length of the work accumulates, it is coiled round the bobbins *q q*. Though I have thought it necessary, for the better understanding of my invention, to describe the complete construction and operation of an engine-loom as improved by me, yet I only claim as my own invention the new arrangement of the shuttles and the slays as connected with the batten, and the suspending of the knotted parts of the leashes on one set of shafts, to arrange with the same as above described.

In witness whereof, &c.

Description

Description of a Scale for Correction of Temperature as applied to the Hydrometer. By Mr. ALFRED AINGER.

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the ENCOURAGEMENT of ARTS, MANUFACTURES, and COMMERCE.

The Gold Vulcan Medal was given to Mr. AINGER for this Communication.

THIS scale is formed generally on the principle of that rewarded two years since by the Society, and published in the thirty-eighth volume of its Transactions *.

The stem of the hydrometer is supposed to be graduated so as to give accurately the strength of mixtures of alcohol and water at some one temperature, which may conveniently be 55° of Fahrenheit. The particular construction of the hydrometer is not material; the divisions may be either the natural series, shewing at once the strength, or they may be arbitrary, like those in Sykes's; if the former, the stem may be made long enough to contain the whole range, or weights may be used, and different portions of the range engraved on different faces of the stem. In either case, a counter part of the divisions in the stem must be engraved at greater length on a wooden, ivory, or metal scale; and it is proposed, in order to avoid the multiplication of instruments, that for this purpose the back of the thermometer be used, which, as the observation is required to be made immediately after the temperature has been taken, is conveniently in the hand for the purpose.

* See Repertory, vol. XXXIX. p. 151.

The middle range of divisions in Fig. 5 (Plate II.) may be supposed to represent the counterpart of those on the stem of the hydrometer; by the side of these are to be engraved others, corresponding with one degree of Fahrenheit, and embracing so much of the middle scale as comprises the amount of affection produced by a variation of one degree in the temperature. On one side (the left) of the middle scale are to be engraved the corrections for variations in temperature below the mean (55°), and on the other side (the right) those for variations above the mean. The former of these is called the *ascending*, and the latter the *descending, correcting* scale; the middle line of divisions may, for sake of distinction, be called the *indicating* scale.

The correcting scales are to be used in the following manner: for every degree that the temperature of the liquor under examination falls short of 55° , or the mean, one division is to be counted upwards on the ascending scale, from the point which the hydrometer gave as its strength, but which would be evidently too low, because the specific gravity of the fluid would have been increased by its defect of heat. In the same manner, one division is to be counted downwards on the descending scale for every degree of heat above 55° . Thus, in the first instance, if the thermometer stood at 48° , which is 7° below the mean, seven divisions must be counted upwards on the ascending scale; and in the second, if the thermometer stood at 60° , which is five degrees above the mean, five divisions must be counted downwards on the descending scale. To facilitate the observations, as to the excess or defect of temperature, the thermometer is to have an additional graduation, as shown in Fig. 1, which, commencing from 55° as its zero, is numbered
above

above and below that point for about 25° , which includes the extreme limits of temperature, under which liquors are liable to be examined. The part above the zero may be marked by the word "DESCENDING," that below by the word "ASCENDING," which will refer to the correcting scale to be used.

The necessity for two correcting scales arises from the circumstance, that an error, amounting in some cases to one-tenth *per cent.*, would be incurred by using the same scale to make the correction both for excess and defect of temperature; the two scales also facilitate the correction by substituting the operation of addition for the more difficult one of subtraction, which, with one scale only, must be used for correcting the effect of high temperature.

To construct the scale, it is necessary to have a set of experiments, showing the specific gravities of a series of mixtures of alcohol and water at various temperatures, the proportions of those mixtures given in terms both of their weights and bulks, and it will be necessary to have the quantity of condensation occasioned in the several mixtures by the chemical union of the two fluids. All these particulars are given in the extensive tables, published by Mr. Gilpin, in the *Philosophical Transactions* for 1794. The perfect accuracy of those tables is not essential to the present purpose, which is merely to point out how the results of similar experiments may be applied to the construction of scales, such as have been alluded to. It must however be recollected, that the language in which the strength of spirits is usually expressed, differs from all the terms in the tables above-mentioned, depending, as will be seen, neither on the specific gravity of the mixture, nor the relative proportions

tions of the constituent fluids. The indications of the hydrometer are given in terms evidently derived from the application of the instrument to purposes of revenue, and which are founded on the arbitrary assumption of a particular mixture of alcohol and water, to which, as a standard, all other combinations are referred. This standard is called "Proof," and the difference between it and any mixture of alcohol and water is described, by saying that the latter is a certain quantity *per cent.* above or below "proof;" meaning, in the first case for instance, that one hundred gallons of a mixture which is *ten per cent. above proof*, may be reduced by the addition of water to one hundred and ten gallons of *proof*; and in the second, that one hundred gallons of a mixture which is *ten per cent. below proof*, contains alcohol enough for only ninety gallons of *proof*. It may be here remarked, that for the reduction to proof of one hundred gallons of spirit *ten per cent. above proof*, it is not enough to add just ten gallons of water, because the chemical union of the two fluids would condense the two quantities into something less than one hundred and ten gallons, perhaps into one hundred and nine and a half; rather more than ten and half gallons of water must be added, and precisely the same remark will apply to the supposed abstraction of water from a mixture which is below proof.

For the reason before stated, that none of the expressions in Gilpin's tables are given in the same terms as those of the hydrometer, a method of reducing the one to the other must be obtained. By a late Act of Parliament it is determined, that proof spirit at 51° shall weigh twelve-thirteenths of an equal bulk of distilled water; if, then, we divide 12 by 13, we obtain .92308 for the specific

cific gravity of proof spirit at 51°, as compared with water of the same temperature ; but as water is supposed to be at 60° when it is made the standard of comparison with other specific gravities, we must multiply .92308 by 1.00063 the specific gravity of water at 51°, which gives .92366 for the specific gravity of proof spirit at 51°, as compared with water at 60°.

Now, by referring to Gilpin's tables under the head " 51°," it appears that a mixture of 100 parts by weight of alcohol *, and 80.85 of water, has the specific gravity (.92366) of proof spirit ; the same quantities by measure or bulk are 100 of alcohol, and 67.00 of water, which will be concentrated or condensed, 4.63 by mixture, leaving 162.37 as the quantity of proof spirit at 51° resulting from 100 parts of alcohol at the same temperature. But as 55° is the zero of our thermometer scale, the constituents of proof spirit must be obtained at that temperature, by transferring the observations already made to the table, headed " 55°;" for although 100 and 80.85 will remain at every temperature, the invariable proportion by *weight* of alcohol and water in proof spirit, yet the *bulks* of those proportions will vary with every loss or accession of heat ; as an instance of which, the *bulks* which at 55°, correspond to the *weights* 100 and 80.85, are 100 and 66.87, these will be concentrated 4.57 by mixture, giving 162.30 for the quantity of proof spirit at 55°, producible by 100 parts of alcohol. From these data the combinations in the tables may easily be described by equivalent expres-

* By alcohol is meant the strongest spirit mentioned in Gilpin's tables, which has a specific gravity of .825 at 60°, and in this sense the word is used throughout the paper. Alcohol is commonly sold weighing but .815 at 60°, and it is well known that it can be procured much lower.

sions

sions in the language of *per-centages* above and below proof; for having found that 100 parts of alcohol will produce 162·30 parts of proof spirit, if we suppose so much water added to 100 parts of alcohol, that the concentrated mixture is a quantity which requires either to be increased or diminished one-tenth, to give the number 162·30, such mixture is evidently ten *per cent. above* or *below* proof, according to the definition already given.

To proceed with calculating the places of the divisions on one of the correcting scales, say the ascending, supposing that the counterpart of the indicating scale is engraved in the manner shewn in Fig. 5, continue the proof mark across the correcting scales. It will be observed, that the place of proof is designated by the letter P, and that the Figs. 4, 5, 6, &c. above and below, signify so much *per cent. above* and *below* proof, the intermediate marks being tenths *per cent.* From the point, coinciding with proof on the left hand or ascending scale, we will begin to calculate the place of the fourth division, which will correspond with the alteration produced in the apparent strength of proof spirit, when it is examined at 51°, which is 4° below the mean; or, in other words, to find what combination of alcohol and water has the same specific gravity at 51°, as proof spirit has at 55°. To ascertain this, refer to Gilpin's table, headed 55°; it shows, as we have before seen, that 100 parts of alcohol and 80·85 of water by weight, or 100 of alcohol and 66·87 by bulk, reduced to 162·30 by condensation, compose proof spirit. Observe, next, what is the specific gravity of this combination, and a short calculation to give the terms intermediate to those in the table, gives ·92196; look now in the table, headed 51°, and ascertain what proportions in weight have the same specific gravity.

gravity at that temperature : another short and similar calculation to interpolate the terms, gives 100 alcohol and 78.02 water ; find next in the table 55°, what are the proportions in bulk of these weights, which are 100 alcohol and 64.52 water condensed 4.47 by mixture, and leaving 160.05 as the total quantity of spirit ; but as this quantity contains as much alcohol as was found necessary for producing 162.30 of proof spirit, it is evident that it is above proof ; how much may be ascertained thus ; subtract 160.05 from 162.30, multiply the remainder by 100, and divide the product by 160.05 ; the quotient is 1.406, showing that when spirit appears proof at 51°, it is actually 1.406 *per cent.* above proof ; this therefore is the place of the fourth mark above proof on the ascending scale, being that which is numbered 196 in Fig. 5. To find the fourth point above this, or the eighth from proof, take the last obtained combination in weight, *viz.* 100 and 78.02, agreeing with 1.406 above proof ; observe its specific gravity at 55° ; it is .92025, and the combination in weight, which at 51° has the same specific gravity, is 100 and 75.26. Transfer these terms to the table 55°, and set down their correspondent values in bulk, *viz.* 100 and 62.24 condensed 4.38, and producing 157.86 of spirit evidently stronger than the last, because the same quantity of alcohol is preserved in all the cases ; repeating the former operation $\frac{100 (162.30 - 157.86)}{157.86} = 2.813$; 2.813 is therefore the place of the eighth point on the ascending scale above proof. By continuing this process, a series of terms will be obtained rising to about 70 *per cent.* above proof. For the present let it be supposed that the five first only are found, *viz.* 1.406 ; 2.813 ; 4.192 ; 5.582 ; 6.973 ; from which we learn that spirit which at 51° appears proof

is really 1.406 *per cent.* above; that which at 51° appears 1.406 *per cent.* above, is really 2.813 above; that which appears 2.813 above, is 4.192; that which appears 4.192 is 5.582. and that which appears 5.582 is 6.973. But the sum total of these five affections of 4° each, ought to correspond with the amount of alteration produced by 20°; that is to say, that spirit which at 35° or (55-20) appears proof, should be really 6.973 above; this however will not be the case; for observing, in Gilpin's table headed 35°, what combination has the same specific gravity (92196) as proof at 55°, we find 100 of alcohol and 67.67 of water by weight, composed in bulk at 55° of 100 alcohol, and 55.96 water, condensed 4.08, and leaving 151.88, which by the former operation $\frac{100 (162.30 - 151.88)}{151.88} = 6.861$, appears to be 6.861 *per cent.* above proof. Now it is clear, that the nature of the scale requires, that this and the number 6.973 before obtained should be convertible quantities, and, therefore, this method of correction cannot be theoretically accurate; the error may, however, be so divided as to be unobservable, by calculating all the terms at intervals of 20°, and then interpolating the intermediate ones; thus the error of 112 (or 6.973—6.861) *per cent.* will be divided, so that only one-fifth of that quantity, or .0224, little more than one-fiftieth *per cent.* will be the error attaching to a correction for 4° of temperature. In a few instances it may amount to .033, or one-thirtieth *per cent.*; these are, however, its extreme cases, and it will be found to amount on an average, to not more than .010 or one-hundredth *per cent.*

It now only remains to give one example of each of the calculations necessary for forming the correcting scales; the

the same principle is pursued in each, but the process is slightly modified, as the term sought happens to be on the ascending or descending scale, and as it is above or below proof, thus making four variations of which the following are examples :

The place of the twentieth division, on the ascending scale, above proof, has been already found to be 6·861, and, against this point on the indicating scale must be placed a mark; the intermediate twenty terms must be interpolated in a ratio similar to that of the five terms of 4° each, already found, *viz.* 1·406; 2·813; 4·192; 5·582; 6·973; whose progression is as nearly arithmetical as possible, and for all the purposes of an hydrometer, may be considered quite so. Indeed it is evident from an examination of those expressions, that the last figure of each decimal is incorrect, arising from the unavoidable errors in the tables themselves. It will not be necessary to show how to obtain the fortieth, sixtieth, and subsequent divisions in this part of the scale, and there can be no difficulty in again dividing these into smaller terms, corresponding each with 1° of Fahrenheit.

For finding the twentieth place below proof on the ascending scale, having before obtained the component parts of proof spirit, by weight, *viz.* 100 of alcohol, and 80·85 of water, look in the table, headed 35°, and observe the specific gravity of such a mixture at that temperature which will appear to be ·93036; next ascertain the bulks of spirit and water, which at 55° have the same specific gravity; they are 100 and 79·78, condensed 5·06, leaving 174·72; then $\frac{100 (174·72 - 162·30)}{174·72} = 7·109$, which is the place of the twentieth division below proof. The fortieth, sixtieth, and subsequent places, will be found in the same manner, and the intermediate points determined as before.

To

To complete the descending scale, or that which gives the correction for temperature above the mean, beginning with the twentieth place above proof, refer to the table, headed 75°, for the specific gravity of 100 of alcohol, and 80.85 of water, which gives .91322; this at 55° corresponds with 100 of alcohol, and 55.79 of water by bulk or measure, which is condensed 4.08, leaving 151.71.

$\frac{100 (162.30 - 151.71)}{151.71} = 6.98$, the required place of the twentieth division above proof. For the twentieth below, find the specific gravity of proof at 55°, viz. .92196, corresponding to which at 75°, is 100 of alcohol, and 96.67 of water, whose bulks at 55° are 100 and 79.94, condensed 5.07, leaving 174.87, $\frac{100 (174.87 - 162.30)}{174.87} = 7.188$.

The following tables show the places of each division for an hydrometer, adapted to give the strength of spirits from alcohol, down to seventy *per cent.* below proof. They are calculated from Gilpin's tables, the measures of the alcohol and water being taken in every case to two places of decimals, and the specific gravities to five; one row of figures shews what part of the indicating scale the point should be placed against, the other, the values of the intervals between each successive point.

ASCENDING

ASCENDING SCALE.					
69.86	0.96	28.71	1.23	20.62	1.57
68.90	0.96	27.48	1.23	22.20	1.58
67.94	0.97	26.25	1.24	23.80	1.60
68.97	0.98	25.01	1.25	25.41	1.61
65.99	0.99	23.76	1.26	27.04	1.63
65.00	0.99	22.50	1.26	28.68	1.64
64.01	1.00	21.24	1.27	30.34	1.66
63.01	1.01	19.97	1.28	32.01	1.67
62.00	1.02	18.69	1.29	33.70	1.69
60.98	1.02	17.40	1.29	35.40	1.70
59.96	1.03	16.11	1.30	37.11	1.71
58.93	1.04	14.81	1.31	38.83	1.72
57.89	1.05	13.50	1.32	40.56	1.73
56.84	1.05	12.18	1.32	42.30	1.74
55.79	1.06	10.86	1.33	44.04	1.74
54.73	1.07	9.53	1.34	45.77	1.73
53.66	1.08	8.19	1.35	47.49	1.72
52.58	1.08	6.84	1.35	49.19	1.70
51.50	1.09	5.49	1.36	50.87	1.68
50.41	1.10	4.13	1.37	52.52	1.65
49.31	1.11	2.76	1.38	54.14	1.62
48.20	1.11	1.38	1.38	55.72	1.58
47.09	1.12	Proof	Proof	57.25	1.53
45.97	1.13	1.39	1.39	58.72	1.47
44.84	1.14	2.79	1.40	60.12	1.40
43.70	1.14	4.20	1.41	61.44	1.32
42.56	1.15	5.62	1.42	62.68	1.24
40.41	1.16	7.05	1.43	63.84	1.16
39.25	1.17	8.50	1.45	64.94	1.10
37.08	1.17	9.96	1.46	65.99	1.05
35.91	1.18	11.44	1.48	66.99	1.00
34.73	1.19	12.93	1.49	67.94	0.95
33.54	1.20	14.44	1.51	68.84	0.90
34.34	1.20	15.96	1.52	69.70	0.86
31.14	1.21	17.50	1.54	70.53	0.83
29.93	1.22	19.05	1.55	71.33	0.80

DESCENDING

DESCENDING SCALE.					
68.97	0.97	29.48	1.26	20.62	1.55
68.00	0.97	28.22	1.27	22.18	1.56
67.03	0.97	26.95	1.28	23.75	1.57
66.06	0.98	25.67	1.28	25.33	1.58
65.08	0.98	24.39	1.29	26.91	1.58
64.10	0.98	23.10	1.30	28.50	1.59
63.12	0.99	21.80	1.31	30.10	1.60
62.13	0.99	20.49	1.31	31.71	1.61
61.14	0.99	19.18	1.32	33.33	1.62
60.15	1.00	17.86	1.33	34.96	1.63
59.15	1.00	16.53	1.34	36.60	1.64
58.15	1.00	15.19	1.35	38.25	1.65
57.15	1.01	13.84	1.35	39.91	1.66
56.14	1.02	12.49	1.36	41.58	1.67
55.12	1.04	11.13	1.37	43.25	1.67
54.08	1.06	9.76	1.38	44.91	1.66
53.02	1.08	8.38	1.39	46.57	1.66
51.94	1.10	6.99	1.39	48.22	1.65
50.84	1.11	5.60	1.39	49.86	1.64
49.73	1.12	4.21	1.40	51.49	1.63
48.61	1.13	2.81	1.40	53.11	1.62
47.48	1.14	1.41	1.41	54.72	1.61
46.34	1.15	Proof	Proof	56.31	1.59
45.19	1.16	1.42	1.42	57.86	1.55
44.03	1.17	2.85	1.43	59.36	1.50
42.86	1.18	4.28	1.43	60.80	1.44
41.68	1.19	5.72	1.44	62.18	1.38
40.49	1.19	7.17	1.45	63.51	1.33
39.30	1.20	8.62	1.45	64.80	1.29
38.10	1.21	10.08	1.46	66.05	1.25
36.89	1.22	11.55	1.47	67.26	1.21
35.67	1.22	13.03	1.48	68.43	1.17
34.45	1.23	14.52	1.49	69.56	1.13
33.22	1.24	16.02	1.50	70.66	1.10
31.98	1.25	17.54	1.52	71.73	1.07
30.73	1.25	19.07	1.53	72.77	1.04

The points given in these tables, after being each divided into four, and applied to the sides of the indicating scale, are to be numbered, beginning in the ascending scale from the bottom, and in the descending scale from the top. It will be sufficient perhaps to number every fourth division, as shewn in Fig. 4 (Plate II.) Fig. 6 shows the size which the divisions might be made on the back of a moderate thermometer, by which it will be seen that tenths, or even half-tenths, may be read with ease; and it appears that it would be by no means superfluous to use a thermometer sensible enough to show half or quarter degrees, when it is seen that one degree affects the apparent strength of the spirit from three to four-tenths *per cent.*; if this were done, it would be necessary that each fourth of the divisions in the above tables should be again divided, to correspond to the effects produced by half degrees of temperature.

*On reclaiming Waste Moor Land.**By J. PEART, Esq. of Settle.*

FROM THE TRANSACTIONS OF THE SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, AND COMMERCE.

The large Gold Medal was given to Mr. PEART for this Communication.

I BEG to lay before the Society an account of the improvement of fifty-six acres, three roods, and twenty-five perches of land, statute measure, lying waste and uncultivated, and the expenses attending such improvement.

Having many complaints, by labourers in husbandry, of the want of work, I was induced to give employment to those who applied for it, by cultivating two parcels of waste

waste ground, the one being at Grassington, called New Pasture Allotment, and containing forty acres and two roods, and the other near Ingleton, called Bastongill, containing sixteen acres, one rood, and twenty-five perches.

The land at Ingleton was of the worst quality I have ever yet seen attempted to be cultivated, being a short ling, on a black, barren, turbary soil; that at Grassington was covered with a strong ling, on turf earth, with yellow soil under the turf. The situation of this land being too high for crops of corn, I have endeavoured to convert it into grass land, and in a way different from any which I have yet seen tried; and though the plan I have adopted has been very expensive, I am inclined to think it will answer better, by the increased expense, than any I have seen practised. The usual way of improving this sort of land for grass (where its situation is too high for crops of corn) has been, either by ploughing, or by paring and burning, or paring only, and then (after draining such parts as required it), sowing it with grass seeds, and liming it on the surface. The objections to this practice are, that the old sward has not been completely destroyed, but has grown in the seams, and the surface, by ploughing, not being made level, a great part of the lime has fallen into the seams, and a considerable part of the surface of the land remained uncovered with lime.

The plan I have pursued on the above parcels of land was, first to burn the ling, where it was strong, then to grave the land with spades; after that was done, I caused the whole surface to be made perfectly level, by cutting it with sharp spades, then had it limed, and sown with grass seeds, grown in the neighbourhood, and white Dutch clover seed; part of the land was sown with seeds before the lime was spread, and the remainder was sown after

after the lime was spread on the surface. The advantage of graving was, getting the ground turned up deeper than if it had been ploughed, and bringing up a little yellow soil, which generally lies underneath the turf, and which tends to make the land firmer, and more congenial to the growth of grass seeds than turf soil, and also getting a much more level surface. As I attach much importance to the land being made very level on the surface, previous to the grass seeds being sown, I was induced to have the whole of this land levelled by persons at day wages, as I hardly knew what it deserved by piece work; and if I had let it by the acre, I feared it might not have been done to my satisfaction. I have laid a much greater quantity of lime, and sown a greater quantity of grass seeds on this land, than I ever before saw practised; and though the expense has been very great, I have no doubt, from the present appearance of the land, the seeds being in a flourishing state, but it will answer a profitable purpose, my opinion being, that the land will in two years fatten any sort of cattle, and be worth, to rent, from twenty-five shillings to thirty shillings an acre, and in its unimproved state it was not, on an average, worth more than three shillings an acre. The land is in my own possession, and it is my intention to buy cattle upon it, and sell them from it, in order to ascertain what profit it will make, and thereby know the advantage resulting from the experiment.

On the land at Grassington, there were a great many lead-mine hillocks, which I caused to be led away, and spread on the blackest earth, which will tend to make the turbary land more firm and stiff.

There are millions of acres of this sort of land in the kingdom, and therefore it appears to me of importance

to find out the best method of bringing this sort of land into grass land, in situations where it is too high for corn; for the most valuable grasses grow well in the highest climates, and in pasturing land it is not of much importance that there are any buildings on the land, or that it is near a town or village.

In the annexed paper, marked No. 1, is a particular of the expenses of improving the land at Grassington, which contains forty acres two roods, and a Certificate, signed by Mr. Bentham, the curate of the parish of Linton, in which parish Grassington is situate, of his belief, that the statement is correct; and there is also the certificate of Emanuel Lawson, who constantly superintended, on my behalf, the improvements on that parcel of land; and in the annexed paper, marked No. 2, is a particular of the expenses of improving the land at Ingleton, containing sixteen acres one rood and twenty-five perches; and a certificate, signed by Mr. Waller, the incumbent curate of Ingleton, of his belief that this statement is correct; and I also hereby certify, that both these statements are accurate and correct.

No. 1. — An account of money paid by John Peart, of Settle, in the county of York, between the 1st of November 1819, and the 12th of November 1820, for improving a parcel of land lying waste and uncultivated, being peat earth, and covered chiefly with strong ling; called New Pasture Allotment, containing forty acres two roods, statute measure, and situate at Grassington, in the parish of Linton, in the county of York.

Paid

On reclaiming Waste Moor Land. 27

	<i>£.</i>	<i>s.</i>	<i>d.</i>
Paid to sundry persons, for graving with spades, forty acres two roods of land, at from 2 <i>l.</i> 2 <i>s.</i> to 2 <i>l.</i> 5 <i>s.</i> per acre	93	3	0
Paid to sundry persons for days' works, for levelling the land with sharp spades, after it was graven, at from 2 <i>s.</i> to 3 <i>s.</i> per day ...	66	13	1
Paid for building a lime-kiln on the land	8	0	0
Paid for 1,504 bushels of hay-seeds, grown in the neighbourhood, sown on the graven land, at from 9 <i>d.</i> to 11 <i>d.</i> per bushel	61	6	7
Paid for 236 pounds of white Dutch clover-seed, sown on ditto	12	2	0
Paid Joseph Tomlinson, for cutting, walling, and filling, 578 rods of stone drains, at 1 <i>s.</i> 1 <i>d.</i> per rod, of seven yards	31	6	2
Paid ditto for cutting, walling, and filling, 300 rods of ditto, at 1 <i>s.</i> 3 <i>d.</i> per rod	18	15	0
Paid William Lambert, for 7,899 loads of lime (each load being three bushels) laid on the graven land, at 7½ <i>d.</i> per load	246	6	10
Paid for leading the lime from the kiln	31	4	11
Paid for spreading the lime on the land	8	17	0
	£.577	14	7

CERTIFICATES.

I, the Rev. John Bentham, curate of the parish church of Linton, in which parish the above-mentioned land is situate, do hereby certify, that I know the above-named John Peart, and believe the above account to be true.

Witness my hand, this 22d day of November 1820.

JOHN BENTHAM.

I, Emanuel

I, Emanuel Lawson, of Threshfield, in the parish of Linton, who superintended on the part of the said John Peart, the improvements above mentioned, do hereby certify, that the above account is true.

Witness my hand, this 22d day of November 1820.

EMANUEL LAWSON.

No. 2.—An account of money paid by John Peart, of Settle, in the county of York, banker, between the 1st of November 1819, and the 12th of November 1820, for improving a parcel of land lying waste and uncultivated, being peat earth, and covered, previous to its improvement, chiefly with short ling, called Bastongill, containing sixteen acres one rood twenty-five perches, statute measure, and situate within the township of Ingleton, in the county of York.

	£.	s.	d.
Paid Foster and Co. for graving with spades 16 acres 1 rood 25 perches, at 3 <i>l.</i> 6 <i>s.</i> <i>per</i> acre	54	4	9
Paid for days' work for levelling the land with sharp spades after it was graven, at from 2 <i>s.</i> to 2 <i>s.</i> 6 <i>d.</i> <i>per</i> day	23	8	3
Paid Spedding and Co. for cutting, walling, and filling, 310 rods of stone drains, at 1 <i>s.</i> 2 <i>d.</i> <i>per</i> rod, of seven yards	18	1	8
Paid for 1,160 bushels of hay-seed, grown in the neighbourhood, and sown on the graven land, at from 8 <i>d.</i> to 10 <i>d.</i> <i>per</i> bushel	48	4	6
Paid for 140 pounds of white Dutch clover- seed, sown on this land	7	4	0
Carried forward	151	3	2

Paid

	£.	s.	d.
Brought forward	151	3	2
Paid for days' work for sowing the above seeds	1	17	6
Paid for leading loose stones from the land..	1	17	0
Paid for 2,410 loads of lime (each load containing three bushels), laid on the land, at 9½d. per load	95	7	11
Paid for spreading the lime, at 2s. 6d. per 100 load	2	15	3
	<u>£.253</u>	<u>0</u>	<u>10</u>

CERTIFICATE.

I, the Rev. William Waller, curate of the chapel of Ingleton, in which chapelry the above land is situate, do hereby certify, that I know the above-named John Peart, and believe the above account to be true.

Witness my hand, this 20th day of November 1820.

WILLIAM WALLER, B.D
Incumbent Curate of Ingleton.

I have now to observe, that the improvements described in my former communication are fully answering my expectations, the land being now covered with a rich sward, and the sheep which were this year put upon it were made very fat. I have every reason to believe, that the land stated to be improved will next year fatten twenty Scot heifers, and fifty ewes with their lambs; and I think it the best and greatest improvement I have seen on this sort of land, and much superior to ploughing, which is the plan usually adopted.

Description

Description of an improved Saw-machine with Sectional Teeth for the Purpose of manufacturing Staves, Heading, and Siding; with Remarks on the Machine, and the Lumber manufactured by it. By ROBERT EASTMAN, of Brunswick Maine.

From the AMERICAN JOURNAL of SCIENCE and ARTS.

With a Plate.

THIS machine consists of a frame about twenty-four feet in length, and five in breadth; and a carriage about twelve feet in length, and four in breadth. The carriage travels with iron trucks, grooved on their circumferences, which run upon iron slides bolted to the inner sides of the frame. An iron centre passes through one end of the carriage, and into the end of the log, and is one of the centres, on which it revolves. At the other end of the carriage, *where there are two cross pieces*, is an iron arbor, which receives the circular iron index with concentric circles of holes drilled at equal distances, and corresponding to the different sizes of the logs to be manufactured into staves, heading, or siding. These holes are called the numbers of the index. On the end of the index arbor, inside of the carriage, is a square to receive a dog fitted to it, which is first driven into the end of the log, and then slipped on the square of the index arbor, by means whereof the index and log are firmly connected together, and both revolve on the index arbor and centre, which are kept in place by stirrup-screws.

Near the middle of the frame is the main shaft, which is of cast-iron, and runs on friction rollers, supported by stands on the floor. On this shaft are the saw and sappers, which are firmly attached to it with screws. The sappers, which are crooked pieces of iron, *steel-edged*, with

with slits to set them at a greater or less distance from the centre, according to the width of the lumber to be manufactured, and partaking of a common motion with the saw, *only at a less distance from the centre*, cut the sap off the log, leaving the thick or outer edges of the lumber perfectly straight.

A band, passing round the main pulley, which is on the main shaft, and on a drum that runs under it, (*which may be driven by a horse, steam, or water power,*) gives motion to the saw, and sets the machine in operation. The saw has only section teeth, and is made of a circular piece of sheet-iron or steel, about one-eighth of an inch in thickness, containing usually but eight teeth, which are set in the outer edge of the saw plate, being dovetailed and grooved in order to remain firm until worn out, when new ones may be set in the same plate.

Under the frame is a small shaft with a large pulley on it (inside of the frame), which is connected to the main shaft by a band; on the other end of this small shaft, at the outside of the frame, is another small pulley, which is also connected by a band to the *feed-pulley*, which is placed near the middle of the frame. On the inside face of this *feed-pulley* are two wheels; one of them, containing eight cogs, is placed in the centre; the other, a squirrel wheel, containing fifty cogs on the inside of its rim, pointing towards the centre. Another short shaft, containing two wheels of about eighteen cogs each, is placed near the middle of the frame; one of these wheels meshes into the rack under the carriage; the other is placed on the outer end of the shaft, to be acted upon by the large and small wheels that are on the feed-pulley, which causes the carriage to feed and return alternately by the different acting of the eight and fifty cog-wheels on the 18 cog-wheel, which not only reverses the motion, but
at

at the same time gives a different speed to the travel of the carriage, in its feeding and returning. Thus, when the 8 cog-wheel meshes into the 18 cog-wheel, the carriage moves forward with a slow motion to feed the saw; when the cut is performed, the feed-pulley with its contents drops, unmashes the 8, and mashes the 50 into the 18 cog-wheel, which reverses and quickens the travel of the carriage in returning, as 50 is to 8. This motion of the rising and falling of the feed-pulley is effected by a lever with a small steel spring at each end of it; each spring has a catch to lock on a pin in the side of the frame, to hold the cog-wheels in their mesh, when the carriage is feeding and returning. In the centre of the lever is a pin, which attaches it to the side of the frame, and is the fulcrum on which it works. On the top of this lever are two wooden springs, which run from the centre to the end, a little rising, which forms an inclined plane.

A knob on the side of the carriage acts on the top of this wooden spring as the carriage is feeding and returning, and alternately unlocks the steel spring from the pin in the frame; and the wooden spring causes that end of the lever where the knob is, to descend, and the other to ascend, and locks its steel spring on the pin in the frame again. The piece of wood which contains the feed pulley is attached to that end of the lever which comes at the middle of the frame, and causes it to ascend or descend at every travel of the carriage. An iron frame is bolted firm on the end cross-piece of the carriage, which holds an iron hand with a steel pointer in it, which, by means of a steel spring, locks into the holes of the index, and keeps the log firm in its place, while the saw is performing its cut.

On

On the inside of the end cross-piece of the frame is a shifting iron, which is a horizontal bar of iron with an elbow, forming an acute angle on the outer end; on the inner end is another elbow, which turns down, forming a right angle, with a bar perforated with holes at suitable distances, to correspond with the numbers of the index. Into the holes in the bar a steel pointer, 7 or 8 inches in length, may be screwed, so as to enter the holes of the index. This iron can move horizontally, being supported with hook bolts, and is kept in place by a small spring acting on the inner end; and two guard screws are set, so as to guide the large pointer into one of the holes in the index when the carriage and log return from the cut.

On the other side of the frame, where the outer end of the hand on the carriage passes, is a small trip iron, that strikes on the outer end of the hand, and unlocks its pointer from the index; at the same time, the large pointer entering one of the holes of the index, and the carriage striking the acute angle of the shifting iron, give it a horizontal motion inward, which causes the log and index to shift one number, when the shifting iron strikes the guard screw; *that* prevents its shifting more than one number at a time. The outer end of the hand being now relieved from the trip-iron, its pointer enters a new hole of the index by means of the spring, and the carriage again moves forward for another cut.

Thus it operates, without any aid except the power that drives it, until it cuts a tier of lumber entirely around the log, like the radii of a circle, leaving their thin edges attached to it. These are then taken off, and another tier cut in the same manner, that is, when the log is large enough to admit of two tiers.

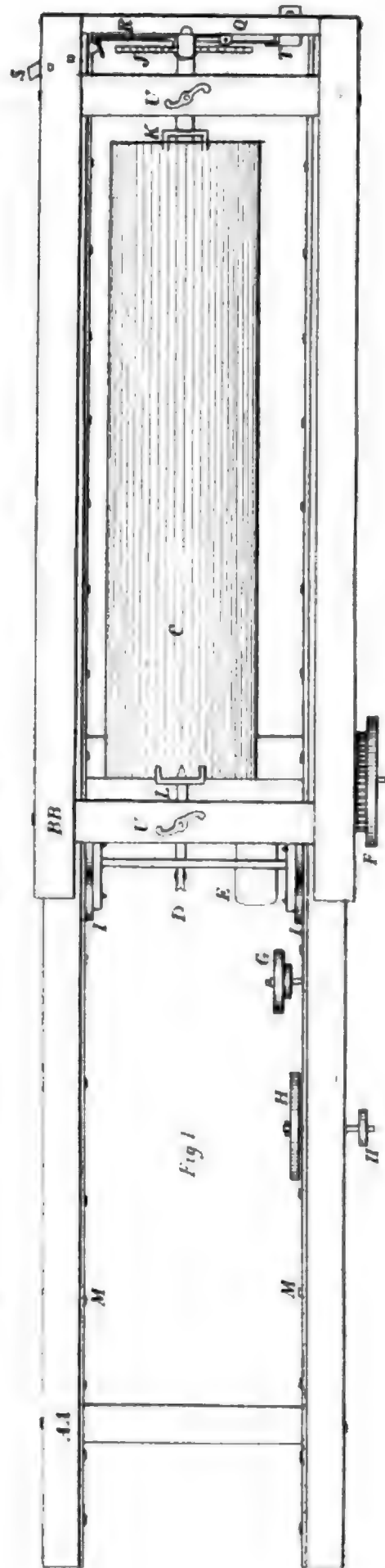
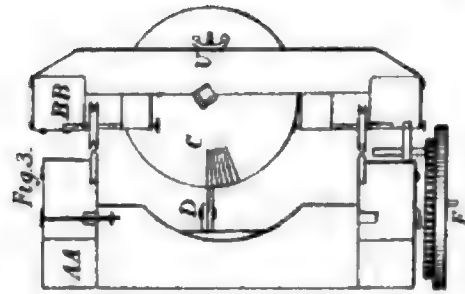
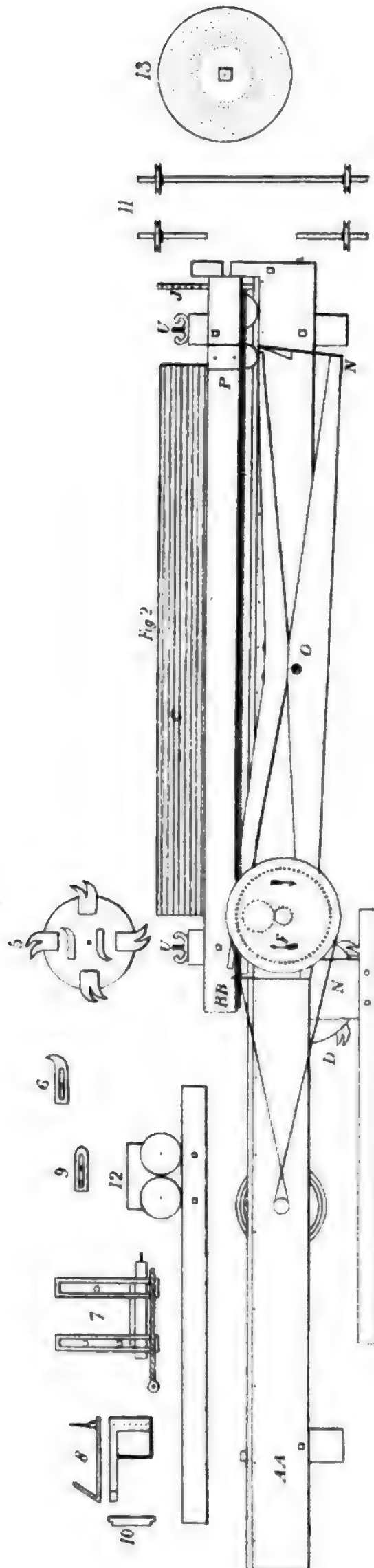
REFERENCE TO THE PLATE.

Fig. 1, (Plate III.) gives a top view of the machine, with the log in it ready for working. Fig. 2 gives a side view of the same. Fig. 3 an end view of the same, with a log as partly cut. Fig. 5 the saw. Fig. 6 the sapper. Fig. 7 the hand-frame, spring, and hand. Fig. 8 the shifting iron in two views. Fig. 9 the setting iron. Fig. 10 the trip-iron. Fig. 11 the trucks. Fig. 12 the stands. Fig. 13 the index.

Reference to the several Parts as put together.

A A the frame, which is made of timber about 8 by 14 inches, and put together by screws. B B the carriage, made of timber, about 7 by 8 inches, put together by screws. C the log, as dogged and put into the machine. D saw and sappers. E main pulley and shaft. F feed-pulley and shifting gear, which is connected to the rack under the carriage. G tightening pulleys. H H regulating pullies and shaft. I I friction rollers and stands. J index. K index, shaft, and cog. L centre iron and cog. M M iron slides, bolted to the sides of the frame for the trucks to travel upon. N N revolving lever and springs. O pin, which attaches the lever to the sides of the frame, and is the fulcrum on which it works. P knob on the side of the carriage that works the shifting lever. Q hand-frame, spring, and hand. R shifting iron and long pointer. S setting iron, which is bolted to the under-side of the carriage, and strikes the acute angle of the shifting iron, when the carriage returns to set. T trip-iron, which unlocks the hand from the index, when the carriage returns to set. U U stirrup screws.

REMARKS,





REMARKS, &c.

This machine furnishes a new method of manufacturing lumber for various useful purposes. Though the circular saw had previously been in operation in this country, and in Europe, for cutting small stuff, it had not, within the knowledge of the writer, been successfully applied to solids of great depth; to effect which the use of section teeth are almost indispensable.

In my first attempts to employ the circular saw for the purpose of manufacturing clap-boards, I used one nearly full of teeth, for cutting five or six inches in depth into fine logs. The operation required a degree of power almost impossible to be obtained with the use of a band; the heat caused the plate to expand and the saw to warp, or, as it is termed, to get out of true. To obviate these difficulties I had recourse to the use of section teeth, and the improvement completely succeeded. The power required to perform a given quantity of work by the other method, was by this diminished at least three-quarters. The work, formerly performed by 70 or 80 teeth, was by the last method performed by 8 teeth; the saw-dust, which before had been reduced to the fineness of meal, was coarser, but the surface of the lumber much smoother than when cut with the full-teethed saw.

The teeth are made in the form of a hawk's bill, and cut the log up, or from the circumference to the centre. The saw may be carried by an eight-inch band, when driven a proper speed (which is from ten to twelve hundred times *per* minute) will cut nine or ten inches in depth into the hardest white oak timber with the greatest ease. The sappers at the same time cut off from one to two inches of the sap, and straighten the thick edges of the lumber.

The

The facility with which this saw will cut into such hard materials, may be supposed to result from the well established principle, that where two substances in motion come in contact, their respective action on each other is in direct proportion to their respective velocities; thus a circular plate of iron put into a quick rotary motion, will with great ease penetrate hardened steel, or cut off a file, when applied to its circumference; and the same principle is applicable to a rotary saw for cutting wood. The requisite degree of velocity is obtained by the continuous motion of the circular saw; by which also it has greatly the advantage of one that has but a slow motion on account of dulling, as the teeth are but little affected, and being only eight in number, but a few moments' labour is required to sharpen them. If the velocity of the saw were slackened to a speed of but 40 or 50 times *per* minute, it would require at least four such bands to carry it through a log as above described.

One machine will cut from 18 to 20 hundred square feet of pine timber *per* day, and two of them may be driven by a common tub-wheel 7 or 8 feet in diameter, having 6 or 7 feet head of water, with a cog-wheel and trundle head, so highly geared as to give a quick motion to the drums, which should be about four feet in diameter. The machine is so constructed as to manufacture lumber from 4 to 10 feet in length, and from two to ten inches in width, and of any required thickness.

It has been introduced into most of the New England States, and has given perfect satisfaction. The superiority of the lumber has for three years past been sufficiently proved in this town (Brunswick, Me.), where there have been annually erected from fifteen to twenty wooden buildings, and for covering the walls of which this kind has been almost universally used. The principal cause
of

of its superiority to mill-sawed lumber, is in the manner in which it is manufactured, *viz.* in being cut towards the centre of the log, like the radii of a circle; this leaves the lumber feather-edged in the exact shape in which it should be, to set close on a building, and is the only way of the grain, in which weather-boards of any kind can be manufactured to withstand the influence of the weather, without shrinking, swelling, or warping off the building. Staves, and heading also, must be rived the same way of the grain, in order to pass inspection. The mill-sawed lumber, which, I believe, is now universally used in the Middle and Southern States, and in the West Indies, for covering the walls of wooden buildings is partly cut in a wrong direction of the grain, which is the cause of its cracking and warping off, and of the early decay of the buildings by the admission of moisture. That such is the operation may be inferred by examining a stick of timber which has been exposed to the weather; the cracks caused by its shrinking, all tend towards the heart or centre, which proves that the shrinking is directly the other way of the grain. It follows that lumber cut through or across the cracks, would not stand the weather in a sound state, in any degree to be compared with that which is cut in the same direction with them. I have no hesitation in stating that one half the quantity of lumber manufactured in this way, will cover and keep tight and sound the same number of buildings for an hundred years, that is now used and consumed in fifty years. Add to this the reduction of expense in transportation, and of labour in putting it on, and I think every one must be convinced that the lumber manufactured in this improved way, is entitled to the preference.

In manufacturing staves and heading a great saving is made in the timber, particularly as to heading, of which

which at least double the quantity may be obtained by this mode of sawing, to what can be procured in the common method of riving it; nor is the straight grained, or good rift indispensable for the saw, as it is for the purpose of being rived. The heading, when sawed, is in the form it should be, before it is rounded and dowelled together, all the dressing required being merely to smooth off the outsides with a plane. Timber for staves ought to be straight in order to truss, but may be manufactured so exact in size, as to require but little labour to fit them for setting up.

Both articles are much lighter for transportation, being nearly divested of superfluous timber, and may be cut to any thickness required, for either pipes, hogsheads, or flour-barrels.

On the Formation of flexible elastic Tubes.

By Mr. THOMAS SKIDMORE.

From the AMERICAN JOURNAL of SCIENCE and ARTS.

I HAVE lately had occasion, in the practice of the Arts, to make use, in a modified manner, of the compound blow-pipe of Hare, supplied with oxygen and hydrogen gases; and, in doing so, have been compelled to seek for some material of which I could make a flexible elastic hose or tube, indispensable to my operations.

Leather, in various ways, was used without success. The intestine of the hog and the bullock, in their natural state, answered a tolerable purpose, for a short time, but they soon cracked, and exhibited fissures, through which the gases escaped very fast, and on being tanned with an infusion of sumach, became very porous, notwithstanding they were surcharged with oils, tallow, &c.

At

At last I imagined that caoutchouc, or India-rubber, might be employed with a prospect of success; and as I obtained it, I trust it may possibly be of importance to some of your readers to be made acquainted with the process I pursued in its manufacture, the detail of which follows, and is at your disposal.

I caused small iron wire to be coiled spirally around a cylindrical rod of iron, as close as it could be laid, of the length, in one instance, of twelve feet. The extremities of this spiral coil were then made fast to the rod (after having been once loosened from it), in manner, such, that, in the subsequent operations, the convolutions of the wire should remain in contact with each other. Over this spiral coil was wound, in a similar manner, a covering of tape, ferreting, or other fabric, so as to completely invest it, and, in a process which is shortly to follow, to prevent the intrusion of the gum to be used into the cavity of the spiral coil before mentioned.

The rubber is now taken, I mean such kind of it as is sold in the form of bottles, and cut into long narrow strips, like carpet rags. This is best effected by cutting them originally into two equal parts, and then reducing them, as near as may be, into the shape of a circular plate, with a pair of sharp tailors' shears, which succeeds in such case much better than would commonly be imagined. These strips are wound over the covering of tape or ferreting above mentioned, in a spiral manner, from one end of the coil to the other, and this in my instance was twice repeated, care being taken to lay, as far as practicable, the fresh-cut surfaces in contact with each other, drawing them so tightly, as to cause them, from their elastic property, to stretch to two, three, or four times their ordinary length. When this was done, another covering of strong tape (linen is to be preferred)

was

was laid likewise spirally over or around the same, from end to end, and secured upon it by very strong twine, laid as closely as could be done, and drawn as tightly as the material would permit. The rod of iron was next withdrawn: the recently-formed hose was then so far bent into a circular form as to be received into a vessel of water, in which it was boiled for an hour or two, when it was taken out, the external covering taken off, and the internal wire and tape withdrawn.

The latter operation at first gave me some trouble, in consequence of the stiffness of the wire; but in preparing other tubes of the kind this difficulty was overcome by annealing the wire previous to commencing operations.

In the course of my little practice, in pursuit of this object, I found that, if the hose so prepared be for any purpose subjected to a second boiling, it has the effect of reducing the size of the hose considerably; so that if this second boiling be even intended, though I know of no reason to desire it unless it be to unite two pieces of hose together, this circumstance should be taken into the account.

I know very well that hose or tubes of this material, made upon glass or metal rods, are stated to have been fabricated; yet, as I was unable to succeed, in that way, in specimens exceeding four inches in length, I concluded, that where twice or thrice that number of feet were wanted, the method was impracticable, and therefore pursued the one I have detailed. It resulted in a hose perfectly elastic, as you may well conceive, and though not very elegant on its exterior, yet very light, and perfectly impervious to the gases it conducts to the blow-pipe to which it is attached.

Account

Account of a new Esculent Vegetable called Tetragonia, or New Zealand Spinach. By Mr. JOHN ANDERSON, Corresponding Member of the Horticultural Society, Gardener to the Earl of Essex, F. H. S., &c. at Cassiobury, in Hertfordshire.

From the TRANSACTIONS of the LONDON
HORTICULTURAL SOCIETY.

THE very general approval which the *tetragonia* appears to have received, as a substitute for summer spinach, has induced me to lay before the Horticultural Society an account of the plant, and of its cultivation as a kitchen garden vegetable.

Though known to botanists for many years, and notwithstanding its value as an esculent had been ascertained by the first discoverers of the plant, the *tetragonia expansa* has been only cultivated as a matter of curiosity till within these few years. The Count D'Ourches, who had obtained seeds of it from the Jardin du Roi, at Paris, first published an account of it as an esculent, and a notice respecting it, which had not been given before, is inserted among the esculent vegetables in the *Bon Jardinier* of the present year.

In the spring of 1820 M. Vilmorin sent a small packet of the seeds to the Horticultural Society as a novelty; these were sown in the garden of the Society at Kensington, and the excellence of the plant was admitted by several persons who tasted it. Last winter Lord Essex brought some of the seeds from Paris, which I raised, and their produce has been continually used at Cassiobury through the summer, and up to the present time.

VOL. XLIV.—SECOND SERIES.

G

Our

Our first knowledge of this plant was derived from Sir Joseph Banks, who discovered it in the beginning of the year 1770, at Queen Charlotte's Sound, in New Zealand, when with Captain Cook in his first voyage round the world. In the account of that voyage, edited by Dr. Hawkesworth, it is mentioned amongst the plants of New Zealand as having been met with once or twice, "and resembling the plant called by country people lamb's-quarters or fat-hen; it was boiled and eaten instead of greens." Specimens and seeds were brought to England, and its introduction by Sir Joseph Banks to Kew-gardens is recorded to have taken place in 1772. In the sketches made of the plant in the voyage, which are preserved in the Banksian library, it is called *tetragonia cornuta*, and Gaertner, who had received specimens from the Banksian herbarium, with this its original name, gave it that appellation when he figured its fruit. It received its present name from Professor Murray of Gottingen, who having obtained the seed, without a knowledge of the history of the plant, published in 1783 a description and figure of it in the Transactions of the Royal Society of Gottingen, as a new plant; he afterwards ascertained that it was the same which was introduced by Sir Joseph Banks, as appears by his edition of the *Systema vegetabilium*, published in 1784: the specific name of *expansa* was, however, retained, as having been the first printed, and for the same reason continues to be used. Professor Pallas had previously, in 1781, published a description and figure of it under another name: he found it in the garden of Count Demidof at Moscow, where it had been received from Baron Jacquin, of Vienna, as *tetragonia cornuta*; Pallas, conceiving it to be a new genus, had called it *demidovea tetragonoides*; but as he appears to have

have been wrong in supposing it distinct from *tetragonia*, his name has of course been discontinued.

The value of the plant became more known in Captain Cook's second voyage. Forster, who went with that expedition, found it also at Queen Charlotte's Sound in great abundance in 1773, and during the stay of the ships at that place the sailors were daily supplied with it at their meals. He also met with it in the same year on the shores of Tongatabu, one of the Friendly Islands. The inhabitants of these countries did not appear to eat it, or to know its good qualities. Forster, in the original drawings of his plants, which are preserved in the Banksian Library, as well as in his publications after his return, named it *tetragonia halimifolia*, though the younger Forster, in his account of this voyage, when he notices the plant, calls it *tetragonia cornuta*.

Thunberg found it growing wild in Japan, where it is called *tsura na*, or creeping cabbage. In his *Flora Japonica* he named it *tetragonia japonica*, but he subsequently corrected himself, and referred his plant to *T. expansa*.

Besides the works above-mentioned, it has also been described and figured by Scopoli, by Roth, and by M. de Candolle. Several of the writers which I have referred to note the plant as biennial, but in our climate it certainly is only an annual.

From the experience which I have had in the cultivation of the *tetragonia*, in the present year, I can venture to recommend the following treatment: the seed should be sown in the latter end of March in a pot, which must be placed in a melon frame; the seedling plants, while small, should be set out singly in small pots, and kept under the shelter of a cold frame, until about the
twentieth

twentieth of May, when the mildness of the season will probably allow of their being planted out, without risk of being killed by frost. At that time a bed must be prepared for the reception of the plants, by forming a trench two feet wide, and one foot deep, which must be filled level to the surface with rotten dung from an old cucumber bed; the dung must be covered with six inches of garden mould, thus creating an elevated ridge in the middle of the bed, the sides of which must extend three feet from the centre. The plants must be put out three feet apart; I planted mine at only two feet distance from each other but they were too near. In five or six weeks from the planting, their branches will have grown sufficiently to allow the gathering of the leaves for use. In dry seasons the plants will probably require a good supply of water. They put forth their branches vigorously as soon as they have taken to the ground, and extend before the end of the season three feet on each side from the centre of the bed.

The branches are round, numerous, succulent, pale-green, thick and strong, somewhat procumbent, but elevating their terminations. The leaves are fleshy, growing alternately at small distances from each other, on shortish petioles; they are of a deltoid shape, but rather elongated, being from two to three inches broad at the top, and from three to four inches long; the apex is almost sharp-pointed, and the two extremities of the base are bluntly rounded; the whole leaf is smooth, with entire edges dark green above, below paler, and thickly studded with aqueous tubercles; the mid-rib and veins project conspicuously on the under surface. The flowers are sessile in the axæ of the leaves, small and green, and, except that they shew their yellow antheræ when they expand, they

they are very inconspicuous. The fruit when ripe has a dry pericarp of a rude shape, with four or five horn-like processes inclosing the seed, which is to be seen in its covering.

In gathering for use, the young leaves must be pinched off the branches, taking care to leave the leading shoot uninjured; this, with the smaller branches which subsequently arise from the axæ of the leaves which have been gathered, will produce a supply until a late period in the year, for the plants are sufficiently hardy to withstand the frosts which kill nasturtiums, potatoes, and such tender vegetables.

The tetragonia is, I understand, dressed exactly in the same manner as spinach, and whether boiled plain or stewed, is considered by many superior to it; there is a softness and mildness in its taste, added to its flavour, which resembles that of spinach, in which it has an advantage over that herb.

My whole crop in the present year consisted solely of nine plants, and from these I have been enabled to send in a gathering for the kitchen every other day since the middle of June, so that I consider a bed with about twenty plants quite sufficient to give a daily supply if required, for a large table.

The great advantage of this vegetable is as a substitute for summer spinach. Every gardener knows the plague that attends the frequent sowing of spinach through the warm season of the year; without that trouble it is impossible to have it good, and with the utmost care it cannot always be even so obtained exactly as it ought to be (particularly when the weather is hot and dry), from the rapidity with which the young plants run to seed.

There seems considerable difficulty in obtaining the
seeds

seeds of the tetragonia; the rapid growth and succulence of the shoots, in consequence of the bed being so highly manured, prevent their ripening, and I am disposed to think it will be desirable to make a separate plantation on a poorer soil for the especial purpose of getting seed, or perhaps to retain some plants in garden pots, to be kept stunted and dry, and to be treated as ice-plants usually are, when seed is designed to be obtained from them.

Account of a successful Method of managing Aquatic and Bog Plants, as practised in the Royal Botanic Garden at Munich. By the Chevalier FRANCIS DE PAULA SCHRANK, Foreign Member of the Horticultural Society.

From the TRANSACTIONS of the LONDON
HORTICULTURAL SOCIETY.

IN all botanic gardens contrivances are to be met with for cultivating aquatic plants, and in most of them, places are also set apart exclusively for bog plants. The former usually consist of ponds of larger or smaller size, which frequently are lined with brick-work, or masonry; or merely of basins or reservoirs, in which the water for watering the garden is collected, and wherein the plants themselves, either in tubs or pots, are plunged at greater or less depths, according to circumstances.

All these methods are, however, attended with great inconveniences: some aquatic plants having very considerable roots, do not well admit of being confined in small tubs or pots; at least these tubs and pots, when filled with growing plants, and the earth that surrounds them, become too heavy to be properly managed. Besides, if the basins are so constructed as to receive the
water

water from artificial fountains, or jets, the fall of the tumbling water necessarily disturbs the vegetation of the plants which it reaches, and spring water is at all times too hard for the nourishment of plants ; for which reason, in basins of this description, let them be ever so much exposed to the sun, confervæ are rarely produced, provided the height of the jet is in due proportion to the diameter of the basin*.

For these reasons ponds are preferred, which are either lined to a certain depth with a thick coat of clay, or made water-tight by means of masonry or brick-work ; they are then filled with mould, and the plants set in them. But such ponds, while they take up far too much room, which might be better employed, do not completely answer their object. For as plants are cultivated in a botanic garden solely for the purpose of being studied with the greater ease, the edges of these ponds can only be planted, the centre part being out of reach ; this space consequently is lost to the garden. If the pond be freely exposed to the sun, without any considerable current in the water, it may be filled with different species of green confervæ, which will spread to the edges of the pond, render the plants that grow there foul, and if they happen to be of a tender nature, even destroy them.

It might possibly be contrived that the ponds being made small, the centre might be reached, but another inconvenience remains unavoidable, arising from the plants themselves. Almost all water plants have creeping roots, in some (as *menyanthes trifoliata*) the creeping stems often change into roots ; it therefore happens that

* These artificial fountains, or water-works, to which the author alludes, are in modern times not much seen in England, but they still form a great ornament to the gardens on the Continent.

the plants placed in a pond soon grow confusedly and wildly through one another; the small, the tender, or, if I may say so, the modestly growing ones, being displaced, or at least hidden from the eye: at the same time the narrow bridges, particularly in large ponds, which one might think of constructing, would require to be too close together, if designed both to facilitate the examination of the plants growing in the pond, and to afford security to the botanist.

The botanic garden at Munich was originally laid out by the Chevalier Schell, keeper of the Royal Gardens. His object, in this undertaking, was to establish the main points, and to provide for what was essentially necessary, at the same time leaving room for such future improvements as might appear, according to circumstances, requisite and advisable. In this state the garden was intrusted to me. I found it incumbent upon me, at the outset, to represent to the government, that I felt the want of two things in this garden, otherwise admirably laid out, *viz.* a rock work, and a place for the growth of aquatic and bog plants. The Chevalier Schell was accordingly charged to supply both those wants, and to consult with me upon the subject. The plan for a rock work, as applicable to a botanic garden, I have submitted to our Academy of Sciences, in whose Transactions it will appear. With respect to the aquatic plants, I communicated to the Chevalier Schell the difficulties above-mentioned, owning, at the same time, that I knew of no remedy. He proposed to me canals, or trenches, constructed of brick-work or masonry, to which I objected their want of durability, and their liability to be disjointed and destroyed by the plants themselves. For whereas, according to Bruggman's accurate observations, plants secrete through their roots fluid particles, which
are

are of an acid nature; as soon as the roots come in contact with the cement or mortar of the brick-work the lime is gradually dissolved, and the roots penetrating through the sides loosen the bricks, and thus gain more air. By this means the plants get, by degrees, into the same kind of entanglement and confusion, which I have adverted to in speaking of the ponds, since the sides of the trenches cannot well be made stronger, than one brick's thickness. These considerations led M. Schell to think of wooden troughs, and he has successfully executed the idea.

Troughs of this description are used in mines, and are like channels or gutters, formed of three planks fastened together at right angles, which consequently have the shape of long parallelograms. If they be made of such wood as will resist the action of the water, and if they, besides, be saturated with tar, they not only effectually withstand decay for a great number of years, but also the encroachment of the roots of the plants, which cannot act upon them, either chemically or mechanically; and their renewal may thus for a long course of years be unnecessary. Now if grooves be cut in the side planks, and cross boards inserted at certain distances, for the purpose of dividing the space into compartments of different sizes, and if these cross boards be made of the same kind of wood tarred in a like manner, by this contrivance just so much room may be given to each plant as may be desired, for it is only necessary to take away from, or to add to these partitions, in order to contract or to extend the divisions. The means are also thus afforded of managing every division differently, since, for instance, to plants which do not want much water (as *salvinia natans*) a deep bed of earth, mixed with small pebbles, may be given, whilst others, that have creeping

roots (as *hydrocharis morsus-ranæ*, *menyanthes nymphoides*, *menyanthes trifoliata*) may enjoy a greater depth of water.

My account will be more perspicuous if I describe this contrivance for aquatic plants as it has been executed in our botanic garden.

The garden has three large reservoirs of water, in each of which the level of the water is raised one foot above the quarters destined for plants. Of these quarters one was set apart for aquatics. In this division were laid down six parallel compartments of troughs so united together, as to present the form of so many Greek Π s, the heads of these letters lying alternately in opposite directions. The troughs are one foot six inches in the clear, and of the same depth; they are made of oak planks three inches thick, and well tarred. They are not laid upon the bare ground, but on strong supporters, which are also tarred, and fastened to stout posts. Stone pillars might also be used for this sub-structure. The space below the cross pieces was kept clear the whole length, so as to prevent the bottom of the trough from touching any thing but its supporters. The troughs themselves received a very slight inclination, not amounting to more than an inch and a half in one hundred feet. This inclination gives to the water a fall which is adapted to all plants; it is sufficient for those that admit of a stronger current, and not too much for such as would be carried away by a quicker stream. It is not easy to confine *salvinia natans* within one division, it will perhaps stray into the two adjoining ones, for where it grows naturally, and is exposed to a more rapid current of water, it will sometimes stretch along the whole extent of the rivulet which it inhabits. The species of *lemna* spread through all the divisions. A slighter fall than that given would create too insignificant a current, and

and the water, besides being liable to be impeded by the plants, might probably become stagnant.

The experience of several years has proved that the plants not only do exceedingly well throughout the summer, the stronger kinds not excepted (as *cicuta virosa*, the species of *nymphaea*, *acorus calamus*, &c.) but also endure well the winter; the fall alluded to being sufficient to keep the water from freezing, if the precaution be used to cut away the herbage of the plants below the surface of the water, and to cover the trough with a roof of boards, upon which horse litter must be placed. By cutting down the plants, that which would retard the flow of the water is removed, and by the covering the frost is counteracted.

In the troughs themselves, at various distances, from one, two, and three feet or more, cross boards, or partitions are inserted, which move in grooves, and serve both to check the excessive spreading of the plants, and, on the other hand, when removed, to add at pleasure to the space. These partitions are somewhat lower than the troughs, in order to allow the current of water to pass over them.

The water required for this apparatus, is conducted from the large upper reservoir by means of a leaden pipe of one inch bore, into the first division of the troughs, where it is discharged with a shoot, about the thickness of a finger, which is sufficient to supply all the troughs, to the extent of five hundred feet, and even all the ground that is interposed. Between the sides of the troughs, spaces of eight feet and a half in width are left, which are divided length-ways into three parts, that is to say, into two pathways along the troughs, and a middle part, rather concave, and five feet broad. This middle part is filled at the bottom with a thick layer of strong loam

loam, upon which garden mould, or finer soil, is put in sufficient quantity to receive the bog-plants*. The concave shape alone is calculated to retain the moisture underneath, longer than a level space would be qualified to do: but it is also provided that the moisture may be increased at will, by letting out the water from the trough into the cavity, by means of apertures at the ends, where the trough turns, and where, for this purpose, a small inclination has been contrived to cause the water to fall. But since these beds are too long to be irrigated sufficiently from one point, an aperture is again made half way in each side of the troughs; by these means the beds are watered from two distinct points.

After the water has flowed through all the troughs, the residue is taken off by a drain of sufficient depth to keep the surrounding ground from becoming too damp; which is easily accomplished, as it runs into a bottom of coarse sand, which is of immense depth all around Munich.

As in a botanic garden, the stronger kinds of plants must of necessity be taken up, from time to time, to be cleansed, to have their roots pruned, and to be set in better order, an apparatus of this description facilitates the labour greatly; you not only get at the plants, altogether, more conveniently than when they are in ponds, but you may also treat the plants in any given division, as you like, without interfering, in the least, with the other divisions.

* We may presume, that the author, instead of making the bed for the bog plants of loam and garden mould, would have recommended peat earth, if that had been within his reach. But that species of soil, we are informed, is not to be met with in those parts where he resides. We know that it is the best suited for the cultivation of the plants in question. Under certain circumstances, it may be improved by a mixture of loam. *Secretary.*

*On the Presence of Ammonia in the Oxyds of Iron formed
in the Interior of inhabited Houses.*

By M. VAUQUELIN.

From the *ANNALES DE CHIMIE ET DE PHYSIQUE*.

HAVING occasion, some time since, to examine the red stains on a sabre, which it was supposed had been employed in an assassination, and that these stains were produced by blood; I detached, with a pen-knife, a small portion of the red matter, which I heated in a glass tube, closed at one end, and into which I had introduced a strip of turnsol paper, reddened with an acid, and wetted.

As soon as the matter was warm, a yellowish steam exhaled, and changed the red colour of the paper to blue. A second experiment made with the matter of a red stain, which covered a knife that was supposed to have been used for the same purpose as the sabre, and was found in the house where the crime was committed, produced exactly the same result.

These two facts gave an appearance of probability to the suspicion that was entertained respecting the nature of the stains with which the knife and sabre were covered: however, these stains resembled rust so much more than blood, that, although a physician who was consulted on the subject did not hesitate to affirm that it was blood, we thought it right to repeat the operation on some common rust; and a piece of iron, found in the closet of the judge, furnished the means. This rust, the purity of which there was undoubted, when submitted to experiments, gave the same result as the others. This discovery, by destroying the suspicions respecting the instruments
in

in question, may be as useful to justice as interesting to chemistry. It proves that rust, which forms on iron in the interior of houses, is susceptible of absorbing the ammoniacal vapours developed in them, and retaining them pretty strongly.

M. Laugier, to whom I communicated this circumstance, confirmed it on some rust that had formed in his laboratory: he likewise obtained traces of sulphurous acid which were developed towards the end of the operation.

Note. — Iron-rust also absorbs animal matters; for, in making the above experiments, we constantly perceived vestiges of brown oil on the sides of the tubes.

Mode of preparing a Green Colour.

By M. SIEBEG.

From the *ANNALES DE CHIMIE ET DE PHYSIQUE*.

M. BRACCONNOT has published a method of preparing a green colour, manufactured in Germany, under the names of *Vert de Schweinfust*, *Vert de Mitis*, or *Vert de Vienne**; but as this process is long and expensive, I think the following, which is my own, may be preferable. Dissolve warm, in a copper vessel, one part of verdigris, in a sufficient quantity of pure vinegar, and add an aqueous solution of one part of white arsenic. From the mixture of these liquids a dirty green precipitate is usually formed: this dirty appearance, which injures the beauty of the colour, it is necessary to destroy; for which pur-

* See Repertory, vol. XLII. p. 314.

pose a fresh quantity of vinegar must be added, until the precipitate be perfectly re-dissolved. Boil this mixture, and after some time a grained crystalline precipitate forms, of a beautiful green, which, when separated from the liquid, well washed and dried, is the colour in question. If the liquor should still contain an excess of copper, some fresh arsenic should be added; if it contain an excess of the latter, copper must be added, and the remainder be treated in the same manner. It frequently happens that this liquor contains an excess of acetic acid, and in that case it may be employed over again to dissolve the verdigris.

This colour has a blueish shade; but in commerce it is frequently required to be of a deeper shade, a little yellowish, and of the same beauty and brilliancy. To produce this change, a pound of potash of commerce must be dissolved in a sufficient quantity of water; ten pounds of the colour obtained by the above process, added to it, and the whole heated over a moderate fire; the mass soon deepens in colour, and acquires the desired shade. If boiled too long the colour approaches to the green of Scheele, but it also surpasses it in beauty and lustre. The alkaline liquor that remains after this treatment may be used again for preparing Scheele's green.

*On the Oxyds of Manganese.**By Mr. BERTHIER, Mine-Engineer.*From the *ANNALES DE CHIMIE ET DE PHYSIQUE*.

MANGANESE has four degrees of oxidation, independently of that which constitutes the manganic acid in the cameleon mineral, namely, the protoxyd, the red-oxyd, the deutoxyd, and the peroxyd. The composition of these four oxyds has been determined with great exactness by Messrs. Berzelius and Arfvredson.

The protoxyd is easily obtained by heating to whiteness the carbonate, or indeed any other of the protoxyds, in a crucible lined with charcoal. We may thus operate on pretty large quantities, provided the heat be continued long enough, the reduction being propagated from the sides to the center of the mass by means of cementation.

The red oxyd is the result of the calcination of the deutoxyd or the peroxyd; the shade of colour varies according to the degree of density of the oxyd whence it is produced; when it is considerable, as in the native peroxyd, the colour of the resulting red oxyd is so deep as to be almost black; on the other hand, when the texture of the peroxyd is very loose, as is the case with that produced by chlorine, the tone of colour in the red oxyd equals in brilliancy the finest colcothar or peroxyd of iron.

Ten grammes of this oxyd having been heated for four hours, in a crucible lined with charcoal, by the strongest fire of a large furnace, were completely reduced, and gave a well-reduced button of manganese weighing 7.34 grammes. This button was mostly compact, and somewhat scoriform on its surface, very brittle, so as to fall
into

into powder in a mortar under the pestle, with a granular texture, and much lustre, exceeding that of the grey-white of cast-iron. The loss of 2.66 shews the proportion of oxygen; it is somewhat less than that found by Berzelius in his experiments, probably because the manganese, like iron, retained a small quantity of carbon in its composition.

Concentrated and boiling nitric acid acts quickly on the red oxyd of manganese; first rendering it brown, and, if long boiled with it, giving the whole a perfect black colour. This product is not the deutoxyd but the peroxyd, as Gay-Lussac has well observed; for after thorough desiccation it loses by strong calcination 0.10 to 0.12 of its weight; whereas the deutoxyd would lose only 0.033. The proportion of peroxyd thus obtained by nitric acid is such as to produce by calcination a quantity of red oxyd equal to 0.55 of the peroxyd employed. It seems, therefore, to me, more natural to consider the red oxyd as composed of two atoms of protoxyd, and one atom of peroxyd, or as follows:

Protoxyd0.621

Peroxyd0.379

1.000

It is difficult to obtain either the deutoxyd or the peroxyd perfectly pure; for one of these oxyds is almost always mixed with a small proportion of the other; but they are found in purity in the native minerals. To obtain the deutoxyd, the nitrate of manganese must be heated to a dull redness, long enough to decompose all the peroxyd, and the temperature must be kept up accurately to this point, that the deutoxyd may not be itself decomposed. Concentrated nitric acid easily acts on the

VOL. XLIV.—SECOND SERIES. L deutoxyd,

been added that it is still in excess, after standing twenty-four hours, the hydrate that is produced has the peroxyd for its base; if, on the other hand, not sufficient chlorine has been employed to decompose all the carbonate, only the hydrate of deutoxyd is formed; but usually there is a mixture of the two hydrates, as the chlorine acts upon the deutoxyd before it has been able entirely to penetrate to the interior of the grains of carbonate, and to decompose them. The carbonate which remains unchanged may be easily separated from the hydrates by acetic or weak nitric acid, either of which will dissolve the carbonate, but will not touch the hydrates in the cold. These two hydrates of manganese appear exactly alike, each assumes the form of a bulky powder, interspersed with small brilliant plates, which retains much water after being drained on a filter. When dried in a water-bath it retains its bulk, and becomes a brown powder, which readily stains the hands.

I analysed each hydrate in the following manner: I first strongly calcined a portion, and found the quantity of red oxyd which it left by the process, and hence estimated the oxygen and water given out by the application of heat. I then distilled another portion in a small glass retort, gradually heated to redness, to which I attached a dry and very light glass tube. During and after the distillation I applied a spirit-lamp under every part of the neck of the retort where any drop of water had condensed, and thus forced it forward to the glass tube, which I had weighed previously to the experiment. The increase in its weight, therefore, after the distillation, was the water that had condensed in it, and had previously existed in the hydrate of manganese. To verify the result, I collected and weighed the residue in the retort

tort after distillation, and, by due calcination, brought it to the state of red oxyd. I found that, during the distillation of the hydrate above mentioned, oxygen begins to escape as soon as the water, and the whole of the latter is not separated till the hydrate has lost from a quarter to a third of the entire quantity. This coincidence is as near as can be reasonably expected, after making allowance for unavoidable errors, and it coincides with the numbers given by Mr. Mitcherlich.

Triple Sulphate of Soda and Ammonia.

Ammonia, which has so great a tendency to form salts with a double base, when added to sulphate of soda, gives rise to a compound which is easily obtained by evaporation and crystallisation. The crystals are large, well defined, and do not deliquesce by exposure to air.

4.98 of this triple salt, dried by a long exposure to open air, were dissolved in water, and decomposed by a known quantity of muriated barytes. The inference from this was, that it contained 2.280 grains of real sulphuric acid, or 45.740 *per cent*.

5.050 grains were heated in a crucible. The salt did not immediately melt in its own water of crystallisation as sulphate of soda does; but on urging the heat, ammonia was given out in abundance, and then sulphuric acid; and, lastly, every thing volatile being expelled by a brisk fire, only 2.129 grains of simple sulphate of soda remained; amounting to 42.360 *per cent*. A second experiment gave 42.298 *per cent*. of sulphate of soda; and the mean of the two 42.329.

The ammonia was determined by oxyd of copper, in the method described above, and was estimated at 9.678 *per cent*.

The

The entire results in 100. parts are as follow :

Soda	18.550	or	Sulphate of soda....	42.239
Ammonia	9.678		Sulphate of ammonia	31.729
Sulphuric acid .	45.740		Water	26.032
Water	26.032			
	100.000			100.000

The result of approaching theoretical results would be,

1 atom of soda	39.092	or	18.016
1 atom of ammonia	2.450		9.887
2 atoms of sulphuric acid	100.232		46.193
5 atoms of water	56.215		25.904
	216.989		100.000

List of Patents for Inventions, &c.

(Continued from Vol. XLIII. Page 384.)

JOHAN RANKING, of New Bond-street, Westminster, Esq.; for the means of securing valuable property in mail and other stage coaches, travelling carriages, waggons, caravans, and other similar public and private vehicles, from robbery. Dated November 1, 1823.

GEORGE HAWKES, of Lucas-place, Commercial-road, Stepney Old Town, Middlesex, Ship-builder; for an improvement in the construction of ships' anchors. Dated November 1, 1823.

GEORGE HAWKES, of Lucas-place, Commercial-road, Stepney Old Town, Middlesex, Ship-builder; for certain improvements on capstans. Dated November 1, 1823.

WILLIAM

WILLIAM BUNDY, of Fulham, Middlesex, Mathematical Instrument-maker; for an anti-evaporating cooler, to facilitate and regulate the refrigerating of worts or wash in all seasons of the year, from any degree of heat between boiling and the temperature required for fermenting. Dated November 1, 1823.

THOMAS FOSTER GIMSON, of Tiverton, Devonshire, Gentleman; for improvements in, and additions to, machinery now in use for doubling and twisting cotton, silk, and other fibrous substances. Partly communicated to him by a certain person residing abroad. Dated November 6, 1823.

THOMAS GAWAN, of Fleet-street, London, Truss-manufacturer; for certain improvements on trusses. Dated November 11, 1823.

JOHN DAY, of Barnstaple, Devonshire, Esq.; for certain improvements on percussion gun-locks, applicable to various descriptions of fire-arms. Dated November 13, 1823.

JOHN WARD, of Grove-road, Mile End-road, Middlesex, Iron-founder; for certain improvements in the construction of locks and other fastenings. Dated November 13, 1823.

SAMUEL SERVILL, of Brown's-hill, Bisley, Gloucestershire, Clothier; for a mode or improvement for dressing of woollen or other cloths. Dated November 13, 1823.

RICHARD GREEN, of Lisle-street, Saint Anne, Middlesex, Sadlers' Ironmonger; for certain improvements in constructing gambadoes, or mud boots, and attaching spurs thereto; and part of which said improvements are applicable to other boots. Dated November 13, 1823.

ROBERT STAIN, of the Tower Brewery, Tower-hill, London, Brewer; for an improved construction of a
blast-

blast-furnace, and certain apparatus to be connected therewith, which is adapted to burn or consume fuel in a more economical and useful manner than has been hitherto practised. Dated November 13, 1823.

JOSEPH GILLMAN, of Newgate-street, London, Silk-warehouseman, and **JOHN HEWSTON WILSON**, of Manchester, Lancashire, Silk and Cotton manufacturer; for certain improvements in the manufacture of hats and bunnets. Dated November 18, 1823.

JOHN HEATHCOAT, of Tiverton, Devonshire, Lace-manufacturer; for a machine for the manufacture of a platted substance, composed either of silk, cotton, or other thread or yarn. Dated November 20, 1823.

THOMAS HOPPER, of Reading, Berkshire, Esq.; for certain improvements in the manufacture of silk hats. Dated November 20, 1823.

ANTHONY DEANE, of Charles-street, Deptford, Kent, Ship-caulker; for an apparatus or machine to be worn by persons entering rooms or other places filled with smoke or other vapour, for the purpose of extinguishing fire, or extricating persons or property therefrom. Dated November 20, 1823.

JACOB PERKINS, of Hill-street, London, and **JOHN MARTINEAU** the younger, of the City-road, Middlesex, Engineers; for an improvement in the construction of the furnace of steam-boilers and other vessels, by which fuel is economised and the smoke consumed. Dated November 20, 1823.

A. Huddell

THE
REPERTORY
OF
ARTS, MANUFACTURES,
AND
AGRICULTURE.

No. CCLX. SECOND SERIES. Jan. 1824.

Specification of the Patent granted to JAMES FROST, of Finchley, in the County of Middlesex, Builder; for certain Improvements in the Process of calcining and preparing Calcareous and other Substances, for the Purpose of forming Cements. Dated April 3, 1823.

TO all to whom these presents shall come, &c.
NOW KNOW YE, that in compliance with the said proviso, I the said James Frost do hereby declare that my process consists in calcining calcareous substances, or any natural or artificial admixture thereof, with other earths or oxyds that are useful for the purpose of forming cements, in such manner, that they may be cooled previous to any access of the external atmospheric air or of moisture; and this I effect by calcining the aforesaid substances in reverbatory furnaces or kilns with a due degree of heat, and which degree will depend upon the nature of the substances acted upon, the purest calcareous substances generally requiring most, and the compound least heat; and by stopping and luting all the apertures

of the furnace, and continuing them closed till the furnace and its contents are cooled; or I withdraw the hot calcined material through an aperture in the floor of the furnace, such aperture being closed during calcination, into an iron or other cylinder with a corresponding aperture, but impervious to air or moisture in all other sides thereof but that in contact with the floor of the furnace, and I allow the calcined material to cool therein, and while another portion is being calcined in the furnace.

For such mixtures of calcareous and other earths and oxyds as can be sufficiently calcined at a bright red heat, I calcine them in tight iron cylinders or retorts heated in furnaces, furnished with safety valves to emit vapour in heating, and to exclude the ingress of atmospheric air in cooling, and allow them to cool previous to withdrawing the calcined mixture; or I attach other cylinders to the ends of the before-named cylinders, to receive the calcined materials, and defend them from the contact of external air or moisture while cooling, and while another portion is being calcined in the first-named cylinders. The cylinders used for cooling should have doorways in them to introduce and withdraw the calcined material, and have doors fitted air-tight or rendered so by luting; the cooling cylinders may also be partly surrounded and inclosed by other larger cylinders, and water being introduced into the space inclosed between them greatly increase the cooling power of the inner one, and the heat absorbed by the water may be applied to various useful purposes.

The furnaces, kilns, and heating cylinders must have proper apertures for charging with, or for occasionally stirring the substances during calcination; but as I do not claim a patent right for the specific form of furnace, but merely for the process of due calcination of calcareous

ous and other substances used for cements, and for cooling the calcined materials, while all access to the external air and moisture is prevented, I intend the aforesaid description only to elucidate my process, and which is equally adopted to pulverised or concrete substances.

I declare my process consists in calcining calcareous substances, or natural or artificial admixtures thereof, with other earths or oxyds for the purpose of forming cements in any manner that they may be cooled without any external access of atmospheric air, or of moisture during the cooling.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

Chalk or carbonate of lime prepared by this method, at a heat not exceeding that at which cast-iron softens, becomes hydraulic lime, and formed into mortar with silicious sand and water, sets and hardens under water.

If the calcination is conducted at a bright white heat, and the calcined substance reduced to a fine powder, and tempered quickly with water to the consistence of common mortar, with or without an admixture of siliceous sand, it speedily sets and hardens in air or water without slacking, merely giving out a very slight warmth.

There are several other new and curious properties in calcareous and other earths, when subjected to the foregoing process, and which the Patentee intends shortly to lay before the public.

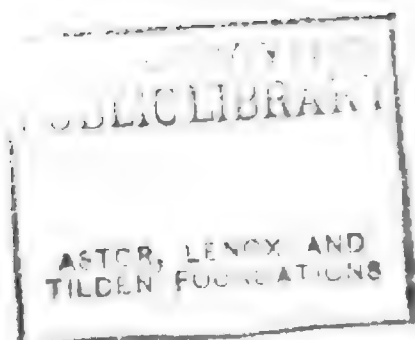
Specification

Specification of the Patent granted to JOHN LANE HIGGINS, of Fulham, in the County of Middlesex, Esq.; for certain Improvements upon the Construction of Carriages. Dated March 2, 1822.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Lane Higgins do hereby describe and ascertain the nature of my said invention of "certain improvements upon the construction of carriages," and in what manner the same is to be performed and operate, is particularly described, and by the plans or drawings hereto annexed, and in the following description thereof; that is to say: My invention consists as represented by the drawings hereto annexed, and as hereinafter described.

Fig. 1 (Plate IV.) represents an horizontal plan of the bed-framing of a four-wheeled carriage, constructed according to my improvements; the body and upper parts are supposed to be removed in order to explain the nature of the invention. Note, the hind and fore-wheels are shewn in a position parallel to each other, or in the direction for the carriage to move along a straight road. Fig. 2 shews an horizontal plan of the same wherein the fore-wheels are upon the lock, or in a proper position to turn the carriage. Fig. 3 represents an horizontal plan of the hind wheels and perch detached. Fig. 4 an horizontal plan of the fore frame and fore wheels, with their appendages; and Fig. 5 shews a transverse section of the fore axle-tree bed, wheels, and appendages; the same characters or letters of reference denote corresponding parts upon all the figures. AA represents the perch which is firmly united to the hind axle-tree bed BB, and strengthened by the iron brace *b b*. C represents



presents a cross-bar which is firmly secured to the perch, in a direction perpendicular thereto, and kept steady by the iron braces *a, a, a, a*. The cross-bar *C* is situated above the fore transom or fore axle-tree bed *E*. *DD* represent two rails which are bolted upon the fore axle-tree bed, and project a considerable distance each way, being nearly perpendicular to the bed *E*; they answer the purpose of the futchels in an ordinary four-wheeled carriage. The fore ends of the rails *DD* are connected together by the splinter-bar *F*, from which the horses draw, and to which the pole of the carriage is fixed. *GG* represents a curved frame of metal, which is secured upon the rails *DD*, and splinter-bar *F*, by screw-bolts or otherwise; the frame *GG* is fixed sufficiently high above the fore axle-tree bed *E*, to allow the perch *AA*, with its cross-bar *C*, to work freely between the upper side of the fore axle-tree bed, and the under side of the metal frame *GG*, as is represented clearly in Fig. 5. 1 and 2 represent pins or small rollers, which are fixed near the ends of the cross-bar *C*, and rise up through curved grooves or arches *c* and *d*, formed in the frame *GG*. The groove *c* is an arc of a circle described round the pin or roller 1 as a centre, and the groove *d* is described round the pin or roller 2; the distance asunder of the pins or rollers 1 and 2 determines the radius of the arcs, as shewn clearly in the figure 1 upon the drawing. 3 and 4 represent two other pins or small rollers, which are fixed upon the upper side of the perch itself; these pins rise up through curved grooves formed in the frame *GG*, in the same manner as the pins 1 and 2. The pin 3 is adapted to work freely in the grooves *e* and *f*, which correspond in radius with the grooves *c* and *d*, as will be clearly seen in the figure 1, at the same time the pin 4 is adapted to work in the grooves *g* and *h*, which grooves are also formed

formed by arcs of circles round the pins or rollers 1 and 2, as centers, the groove *g* being described from the pin 1, and the groove *h* from the pin 2. The curved frame *G G*, with its grooves, I will denominate a *double centre perch*, since it operates when turning the carriage, by moving upon different centres when the carriage is turned to the right or to the left, instead of turning upon one common centre under the middle of the carriage, as is the case in ordinary four-wheeled carriages, with the perch-bolt situated in the middle of the fore axle-tree bed; it is this circumstance which constitutes the advantage of the present invention, as will be hereinafter explained. When the carriage is drawn straight forwards, the small rollers 3 and 4 bear at the points 5 and 6, see Figs. 2 and 4, where the curved grooves *e* and *f*, and *g* and *h*, intersect at the same time, the small rollers 1 and 2 bear in the rounded extremities of the grooves *c* and *d*, as will be evident from inspection of the Fig. 1; in this situation the hind wheels will be steadily drawn forwards along with the fore wheels by means of the perch. But when it is required to turn the carriage upon the road, the effect of the above-mentioned double centre perch is as follows: Suppose the carriage is intended to be turned round to the left-hand, as represented by the plan Fig. 2, the horses force the pole of the carriage to the left hand, which causes the pin or small roller 2 upon the cross-bar *C* of the perch to bear steadily in the rounded extremity of the curved groove *c*, thereby forming a centre of motion for the whole fore frame and fore wheels to turn upon; at the same time the rounded extremity of the groove *d* quits the small roller 1, and the said groove slides along by the roller without opposition. This action causes the groove *h* to slide by the roller 4, and the groove *e* to slide by the roller 3; by this arrangement, the whole fore
frame

frame and fore wheels turn round steadily upon the pin or small roller 2, as a centre of motion, which centre of motion being near to the wheel H, towards which the carriage is turning, does not oblige that wheel to move much under the carriage, and consequently admits of a larger fore wheel being used, or a much shorter perch without interfering with the body of the carriage, as is the case with the ordinary fore wheels of carriages, which move on a centre or perch bolt, situated in the middle between the two fore wheels. When the carriage is intended to be turned to the right-hand (or in a direction opposite to that shewn in Fig. 2), the rounded extremity of the groove *d* bears against the small roller 1, and forms a centre of motion for the fore frame and fore wheels to turn upon, which centre would be near to the wheel I, and operate in the manner before described, to prevent the wheel from turning so much under the body of the carriage. In some cases it may be thought advisable to affix the curved frame to the fore end of the perch, and have the small pins or rollers before-mentioned affixed to the fore frame of the carriage, so as to enter into the grooves in the curved frame, in which case the curved frame must be placed in a position reversed to what is shewn in the Figs. 1, 2, and 4, the operation of the two would be similar. The manner of arranging and forming the grooves in the curved frame may be varied in many ways, still producing the desired effect, *viz.* of the two centres of motion for the fore wheels of the carriage to turn upon; for instance, the external parts of the curved grooves in the frame G G might be dispensed with, as represented in the Fig. 4 on the drawing, where the external parts are represented in outline only *, whilst the

* The parts of the grooves here alluded to are distinguished upon the plate by dotted lines in Fig. 4.

necessary

necessary parts for the small rollers to act against are coloured or shaded. By these improvements so invented by me, as applicable to the construction of four-wheeled carriages in general, and which improvements are so specified and described as aforesaid, a gig, cabriolet, or curricie, may be easily converted into a phaeton, by having a dicky-box or servant's seat mounted upon a pair of hind wheels, with my double centre perch frame projecting out from it, so as to enter beneath the gig body, and have the small rollers fixed to the gig body to enter into the grooves in the frame, and be kept in their places by screw-nuts upon the top of the small rollers, or in any other suitable manner.

I hereby declare that I do not make claim to any new method of forming the wheels, axle-trees, or other parts of the carriage, but only to the invention of the new *double centre perch*, as applicable to most descriptions of four-wheeled carriages, to produce the advantages hereinbefore described and set forth; the form and proportions of the parts may be varied according to the nature of the carriage for which they may be intended, or according to the discretion of the workman, as well as the materials of which the same may be made.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

I have driven a carriage on this construction many hundred miles, and found it fully to answer my expectation, and the purposes intended.

Its advantages over the common plan are :

1st. It admits of more lock to the carriage when turning, the fore wheel on which the carriage is turning nearly stands still, while the other performs the revolution.

2d.

2d. It admits of large fore wheels which should be in the proportion of 4 to 5 to the hind wheels ; whereas the present fashion of hanging the bodies low, for safety and convenience of getting in and out, has necessarily reduced the fore wheels to one-half, and in many instances to less than half the size of the hind wheels, by which the friction and draft are very much increased. These objections are obviated by this plan, the fore wheels may be of the proper proportion, by which the draft is made lighter and the carriage to run with more ease ; the perch may be shorter without raising the body or affecting the present mode of hanging it. There are three perch bolts.

This plan renders the carriage much safer ; there are few instances of a carriage being upset till it is on the lock, when the fore wheel comes back under the carriage ; but by this plan the fore wheel on which the carriage is turning always stands out, and prevents the carriage being upset by turning too suddenly.

This plan is particularly adapted to light carriages, which are made to transpose from phaeton to barouche, where a difficulty occurs of getting a convenient step into the hind body ; by this plan, as the fore wheel does not come back on the lock, it is as easy to have a convenient step to the hind body with a short perch, as it is by the common plan with a long perch.

The frame in which the bolts work, as specified in the drawing, were adopted as precautionary rather than as necessary ; a carriage on this plan is as easily constructed, and on as simple as the common plan.

Carriages on this plan are built by Messrs. Sanders and Co. 71, Upper Berkeley-street, Portman-square.

The Patentee will treat with any Coach-maker for a license to use the patent.

Specification of the Patent granted to JAMES SMITH, of Droitwich, in the County of Worcester, Civil Engineer; for an Apparatus for the applying Steam to the Boiling and Concentration of Solutions in general, crystallising the Muriate of Soda from Brines containing that Salt, melting and refining of Tallow and Oils, boiling of Sugar, Distilling, and other similar Purposes.

Dated June 19, 1823.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said James Smith do hereby declare that the nature of my said invention does consist in a new manner of constructing a steam-boiler, with a flat and extended top or upper surface, and in performing the various operations set forth in my said hereinbefore recited title to my said patent, on the top or upper surface of such boiler as aforesaid; and in further compliance with the said proviso, I the said James Smith do hereby also describe the manner in which I perform my said invention, by the following description thereof, reference being had to the drawing and figures annexed thereto; that is to say: The drawing represents a cross section of my said apparatus. A, Fig. 1 (Plate V.), is my said steam-boiler, having a flat top or upper surface C; and in order to give the required strength to a boiler of this shape, I tie the top and bottom of the same together by bolts, as shewn in the drawing. The fire is applied to the bottom of this boiler B, in any of the ordinary ways now in use. C, which is the top of the boiler A, is also the bottom of the pan or vessel required to perform the various operations set forth in my said hereinbefore recited title to my
said

Mr. Smith's Patent.

Fig. 1.

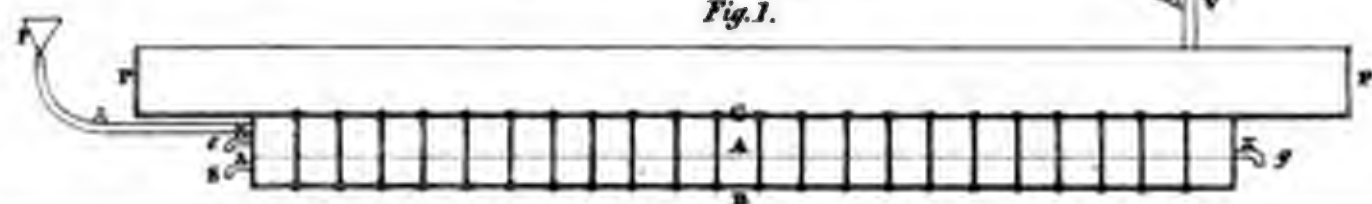


Fig. 3.

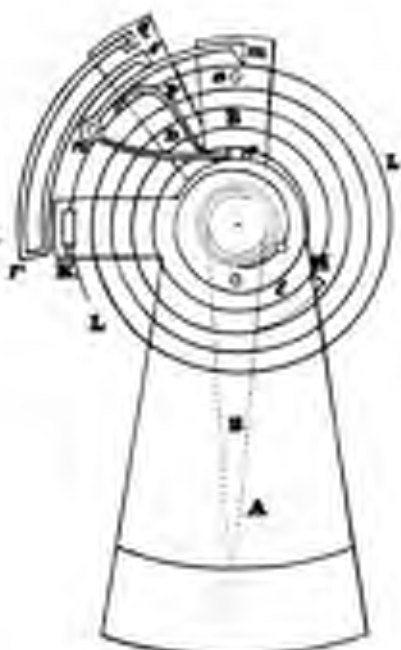


Fig. 2.

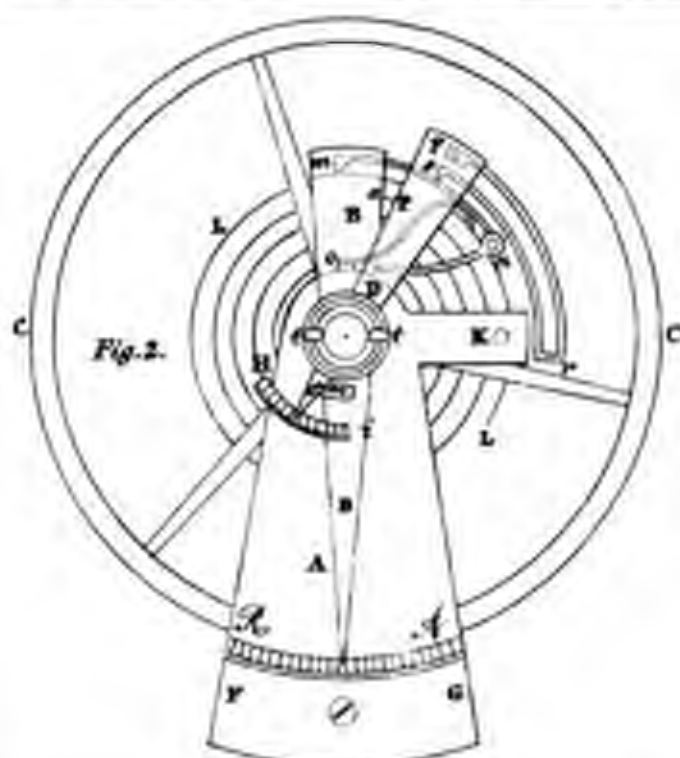


Fig. A.

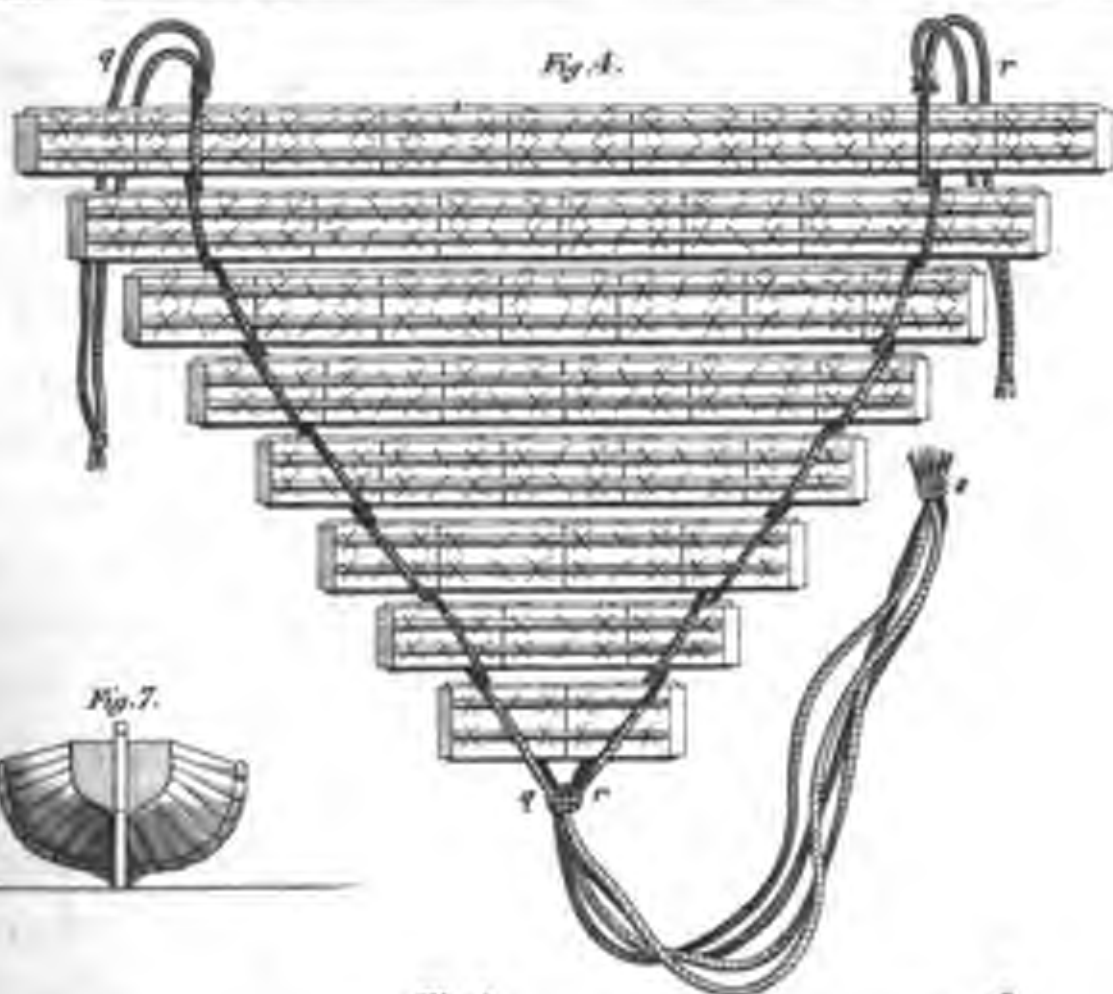


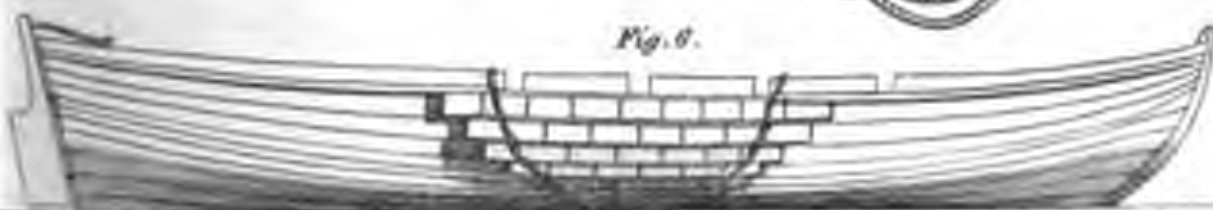
Fig. 5.

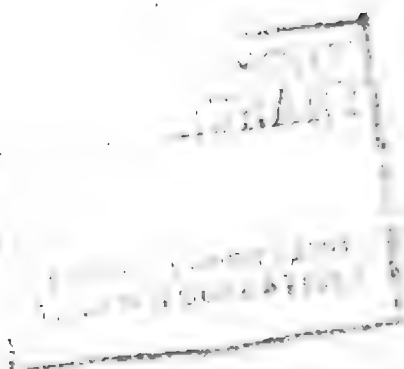
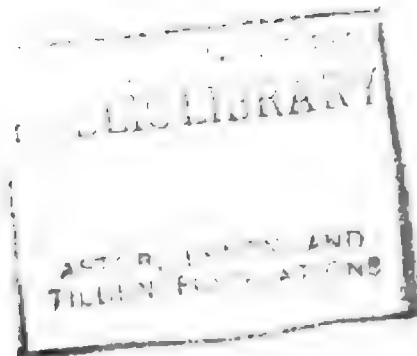


Fig. 7.



Fig. 6.





said patent. P P are projecting sides to the same, and are particularly useful in the evaporation of all saline solutions, because by this arrangement the edges of the pan are kept cooler than all the other parts of it, and the fluid is not only thus prevented from boiling over, but the salt as it forms is thrown by the ebullition upon this projecting part, and less incrustation is formed at that part of the bottom of the pan which is more immediately acted upon by the steam. When my said apparatus is to be set to work, water should be introduced into the boiler by means of the funnel and feed-pipe F, to the depth of about two inches; g is a guage cock, by which to ascertain when the water attains that depth. S is a cock for the purpose of drawing off the water again when occasion shall require; and e is a cock for giving vent to the rarified air when necessary. V is a safety valve. By this arrangement it will be seen that fire being applied to the bottom of the boiler A, steam will be generated and distributed over the whole of the bottom of the pan above it. The fluid in the pan, being exposed to the atmosphere, will always be sufficiently cool to cause a condensation of the steam below on the bottom of the pan, which will find its way again in the form of water to the bottom of the boiler, there again to be converted into steam, by reason of which the water in the boiler will very seldom require to be replenished. This boiler is formed of plates of metal rivetted together at the edges in the usual way for making boilers; and as to the general dimensions of my said apparatus, I have found the following answer perfectly for the purpose of evaporating brines; that is to say, the boiler to be nine inches deep, twelve feet wide, and fifty feet long. The pan to be the same length as the boiler, but to project eighteen inches wider at each side of the boiler. The
pan

pan to be twelve inches deep, the bottom and sides of the boiler and the sides of the pan to be a quarter of an inch thick, and the bottom of the pan or top of the boiler to be three-sixteenths of an inch thick. The bolts which tie the top and bottom of the boiler together should be about six inches apart from each other throughout the whole boiler, and should themselves be about three-fourths of an inch thick.

Now these pans hereinbefore described as used for the evaporation of brines, may require some slight alteration in form or additional strength when used for the boiling of sugar, or for the melting and refining of whale or other oil or tallow, or for distilling or other purposes to which they may be found applicable. But a steam-boiler so constructed as aforesaid, and a pan or other vessel so arranged on the top or upper surface of such boiler as aforesaid, for the purposes set forth in the hereinbefore recited title to my said patent, being to the best of my knowledge and belief new, and never before used in these kingdoms, nor in his said Majesty's Colonies and Plantations abroad, I do hereby declare this to be my specification of the same, and that I do verily believe this said specification doth comply in all respects fully and without reserve or disguise with the said proviso, in the said in part recited Letters Patent contained. And I do hereby, therefore, propose to maintain my exclusive right and privilege to my said invention.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

The characteristics of the apparatus described in the foregoing specification are *simplicity, power, and safety*; and it will be found without parallel, having neither extra boiler,

boiler, feed-pipes, force-pumps, or any other complication, which in former applications of steam, has rendered it both expensive, and subject to much derangement. The vessel can sustain no injury by the action of the fire, or the neglect of servants, as it generates, condenses, and regulates its own steam, and may be entrusted to the care of the most ordinary labourer; and being once furnished with the necessary quantity of water needs no further supply. It may be made of any size or shape, to suit the convenience of parties, to give any temperature of heat up to 1000 degrees, and in the event of transportation may easily be set up, by common workmen.

Persons desirous of adopting this invention, are respectfully solicited to inspect its operative parts, at Droitwich, in Worcestershire, where it is now applied to the manufacturing of salt from brines (which boil at a temperature of 226° of Fahrenheit), attended with advantages exceeding all calculation, namely:—Two vessels thirty-seven feet long and ten feet wide, are found to make four times the quantity of salt, in the same time, as vessels of equal dimensions upon the old principle (of superior quality, owing to the equal distribution of heat), with a saving of full two-thirds of fuel, and a proportion of manual labour; as also avoiding the sediment or *pan-scratch*, so destructive to the vessels at present in use; to which may be added, the stoppage of works during repairs; as when the improved vessels are carefully constructed, no repairs can possibly be required for a great length of time.

It will be found equally valuable in the boiling of sugars in his Majesty's Colonies; also in melting and refining of tallow and oils; distilling; and all other purposes, subject to injury from the application of fire, or requiring a regular and uniform heat.

The

The proprietor will treat liberally with the public for the use of this Patent; as also, for his newly-invented high pressure steam-engine boiler (having lately obtained his Majesty's Letters Patent for the same), which will be found equally beneficial to the propelling of machinery, it being capable of supporting any degree of pressure to 1000 lbs. upon the square inch, and is neither liable to explosion, or injury by the application of fire. The specification of this last-mentioned Patent will appear in a future number of this work.

Specification of the Patent granted to JOHN SADLER, of Penlington-place, in the Parish of Lambeth, in the County of Surrey, Gentleman; for a new and improved Method or Process of manufacturing Carbonate of Lead, formerly denominated Ceruse, but now commonly called White Lead. Dated January 3, 1820.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Sadler do hereby declare that my said invention consists in the production of carbonate of lead, by decomposing sub-acetate of lead by the transmission into or upon it of carbonic acid. The carbonate of lead is the substance formerly denominated ceruse, but now commonly called white lead. The sub-acetate of lead is the substance described in the "*Pharmacopœia Londinensis*," page 58, edition 1815, as *Liquor Plumbi Sub-acetatis*. The preceding statement will sufficiently explain to every practical chemist the nature of my discovery, and will enable every such person to repeat the process by which I produce white lead. For more general

ral information, however, I add the following account of the mode in which the process is usually conducted by myself: I place a solution of sub-acetate of lead (*liquor plumbi sub-acetatis*) in a cask or other vessel, either closed or open (though I consider a closed vessel preferable), and I then introduce into the same vessel carbonic acid, either in a state of gas or in solution. I use frequent agitation of the ingredients to favour the combination of the carbonic acid with the oxyd of lead which is contained in the solution of sub-acetate of lead. A precipitate is formed consisting of carbonate of lead (that is of white lead or ceruse); I continue this operation as long as any absorption of carbonic acid takes place, supplying such additions of carbonic acid during the said process until precipitation ceases. The carbonate of lead (ceruse or white lead) thus produced, I separate from the fluid by decantation or filtration; and I wash and dry the product in the manner in which white lead is commonly washed and dried.

In witness whereof, &c.

Description of an improved Hammer for Turret Clocks.

By Mr. W. WYNN, of Dean-street, Soho.

With a Plate.

FROM THE TRANSACTIONS OF THE SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, AND COMMERCE.

The sum of Twenty Guineas was presented to Mr. WYNN for this Communication.

THE great expense attending the manufacture of turret clocks is occasioned by the magnitude of the machinery which is necessarily employed in raising a ponderous hammer,

hammer, which shall strike with sufficient force on a large bell, to produce a sound capable of being heard at a distance from the clock, so as to be useful to the surrounding neighbourhood. It cannot fail to be evident to every one acquainted with the subject, or to any mechanical gentleman who would take the trouble to examine the hammer-work of turret clocks, that a great portion of the force of the percussion of the hammer is lost before it comes in contact with the bell, and, consequently, a great deal of power is exerted in vain in lifting them. The counter-spring of the hammer (a spring which supports the hammer from resting on the bell) opposes considerably greater resistance to the blow than the actual weight of the hammer, because it has the power of supporting it much above that part of the bell on which it strikes. The friction that takes place between the counter-spring and the hammer is very great, in consequence of the rust which it unavoidably contracts by its necessary exposure to the open air; and, I think, I should not over-rate both these resistances if I estimated them at equal to twice the weight of the hammer. Having been so fortunate as to obtain the sanction and approbation of the Society of Arts for a time-keeper, which I submitted to them a short time since, I have been encouraged to make a second attempt to obtain their patronage, by presenting them with the model of a hammer for a turret clock, wherein I have succeeded in annihilating both the above resistances, and have made such other improvements in raising the hammer, preserving its pivots from rust, and unlocking the striking part, as I trust will be found of importance to the manufacture of turret clocks, as it regards a reduction in their original expense, by lessening the maintaining power, and, consequently, the magnitude of the work; preventing the necessity of subsequent

sequent repairs, and causing a greater degree of accuracy and certainty of performance.

I have constructed a hammer without a counter-spring, which has the advantage of falling with the whole force of the percussion on the bell without any resistance, and of being caught up at one-fourth of the height from which it fell by the re-action of the blow; consequently releasing the power of the striking train from the exertion of lifting the hammer equal to that quantity. A hammer on this principle will, therefore, strike a bell with far greater force than one on the usual construction; and it will also oppose but three-fourths of the resistance by its draught on the striking train. On the axis of my hammer is a ratchet, and a click is made to act in it, which has a spring like the hammer-spring of a gun-lock, which will force the click both against the ratchet and (by a small change of position) away from it. There is a lever on the ratchet which goes under the click, and which forces the click away from the ratchet when the hammer is raised to strike the blow, and, consequently, gives liberty for the hammer to fall; but, just before it strikes the blow, the lever comes in contact with another lever attached to the click, and brings it again in contact with the ratchet, ready to catch the hammer at any height to which it may rebound.

Much friction is occasioned by the pivots of the hammer becoming rusty from their exposure to the atmosphere, which causes a considerable resistance to its draught, and which I have found means to prevent, by putting a brass collar over the pivot, so as to form a sort of cup or receptacle for oil, which collar enters freely into a groove in the collet in which the pivot-hole is made. By filling with oil the pivot-hole, which is closed air-tight at the end on the outside, the oil will flow over

into the cup, where it will be retained by the pressure of the atmosphere and by attraction of cohesion, and will completely exclude all moisture from the pivot, which by this means will be prevented from becoming rusty, and will very much reduce the resistance both in the rising and the falling of the hammer.

- By the application of a hammer thus constructed, I shall derive a great advantage from the accelerated force of falling bodies, which could not be done where a counter-spring is made use of; for, if a hammer had too much fall given it, the counter-spring would not have a sufficient command of it to prevent it from chattering the bell. By the shortness of the draught of the hammers now in use, the accelerated force of the percussion is not taken advantage of; for a hammer of a given weight, which falls from a height of eight inches, will fall with four times the force of one from four inches, and cause but twice the resistance; and one falling from twelve inches will fall with nine times the force of the first, and only increase the resistance to three times the quantity. In a hammer constructed on the principle I now produce, there will be no objection whatever to a long draught; on the contrary, it will rebound with more force by falling from a great height than from a lesser one, and thus obtain the advantage of the accelerated force of falling bodies. In the large turret clock at the Royal Military College, which I have the management of, there is a hammer that weighs fourteen or sixteen pounds, which does not fall from a greater height than two and a half or three inches. If this hammer were reduced to one-third of its present weight, and its perpendicular action increased in a three-fold proportion, the resistance to the train would be the same as it now is, and the addition acquired in the force of its percussion, by the accelerated force, would be
three

three times as great, without taking into consideration the loss of that resistance which the counter-spring opposes; consequently, the bell would be heard with greater effect in its immediate vicinity, and the utility of the clock would be extended to a far more distant circuit.

I have also found a great resistance in the common mode of lifting the hammer by a hammer-tail, both from the great length of space which the pin has to pass along the hammer-tail, and the difficulty of making the oil remain on a straight long surface, and that, in an inclined position, subject to continual jerks by the falling of the hammer; so much so, that, when I have found the striking-part of turret clocks stopping by the cold inclement season, I have made them go by fresh oiling the hammer-tail only, a proof that the resistance of that part of the clock has considerable influence on its performance. I have succeeded in lessening this friction by the application of a compound-toothed sector on the pin-wheel of the striking train instead of pins, which acts in a simple-toothed sector instead of a hammer-tail, and which reduces the friction in the proportion of twice the versed sines of twelve angles of $3^{\circ} 45'$, and twice the versed sines of 45° . I have made the compound-toothed sector by cutting a wheel of ninety-six teeth, and filling out six teeth and leaving six, alternately all round the wheel, and the simple-toothed sector of the same radius as the wheel with six teeth, instead of a hammer-tail to act in it; so that when the teeth of each branch of the compound sector have passed through the simple one, it lets it fall in the same way as the pin would let the hammer-tail fall. Besides lessening the quantity of friction, the resistance to the train will be equal in all positions of the leverage, and the oil will adhere far more tenaciously to teeth than to a plane surface, and it must be the means
of

of preventing the mis-performance of the clock by the inclemency of the weather, a thing which often occurs, and which is attended with much inconvenience, particularly where a workman is not at hand to remedy the defect.

The same principle is applicable to the lever of the unlocking detent, to relieve the watch part from a great portion of friction in unlocking the striking part. In the model I now produce, I have made a pinion of twelve with two of its leaves filed out, which represents the axis of the motion-wheel, which revolves by the power of the watch part once in an hour. This pinion, or rather toothed sector, as it revolves, gathers up a toothed sector with ten teeth of a circle of 144 teeth, whose radius is as twelve to one of that of the pinion; and when that part of the pinion which has lost its teeth comes round towards the axis of the sector, it will of course let the lever fall, and the striking part will be released. On the scale which I have made the model, I produce 1·8 inch of motion at the end of the lever; to accomplish this quantity of motion by the spiral curved plate (the best method now in use), the smallest radius of which, is ·5 inch, and the largest one of 1·8 inch, there will be a plane of $7\frac{1}{2}$ inches pass under the lever; but to produce the same quantity with toothed sectors of the proportion of twelve to one, the length of whose legs are 2·7 inches, and ·225 inch, the friction will be only as the versed sines of ten angles of $2^{\circ} 30'$, and the versed sines of ten angles of 30° , which compared with $7\frac{1}{2}$ inches, gives the relative proportion of the friction of the toothed sectors, and the spiral curve. Beside so materially reducing the friction, I produce the necessary quantity of motion by a lever, viz. the pinion, at only ·225 inch from the center of motion, instead of its acting at from ·5 inch to 1·8 inch from

from the centre, which it would do if the spiral plate were used, which of course lessens the resistance on the watch part in the proportion of those numbers.

The sound produced on a bell by the new-constructed hammer will be perfectly pleasant, as there will be no possibility of the hammer's chattering on it. All turret clocks are susceptible of being altered, and all or either of the new principles may be applied to any which are now made. In such clocks as are in the habit of stopping in cold weather, the application of the toothed sectors would be the means of preventing that inconvenience, and in those where it might be desirable to extend their utility by increasing the sound of the bell, the application of the new hammer would attain that object in a high degree. By the application of all the new principles in the manufacture of turret clocks, the weight of the hammer will be so lessened, and the friction of drawing it so reduced, that comparatively small machinery will lift them, and that too with more certainty and accuracy than the large machinery will lift the hammers now in use, because the diminution of the general dimensions of the work will lessen the friction in all its parts, and the expense of the manufacture will be lessened very materially thereby. Any number of hammers may be raised by the toothed sectors.

The principles are applicable to the construction of common house-clocks, and would be a great improvement to them, without materially increasing the expense of their manufacture. In fact, all the levers of the repeating work might be put in motion by the toothed sector, which, as it would reduce the friction, would cause a greater certainty of performance, increase the durability, prevent the necessity of repairs, and cause the clock to keep time more correctly.

RE-

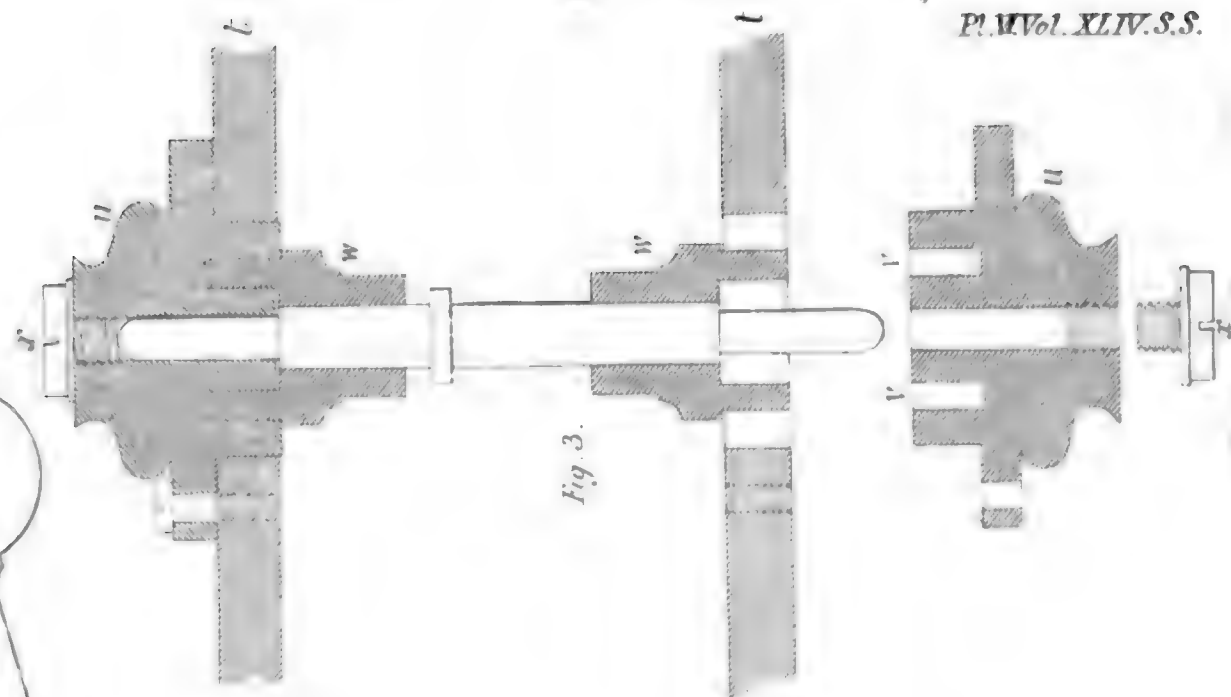
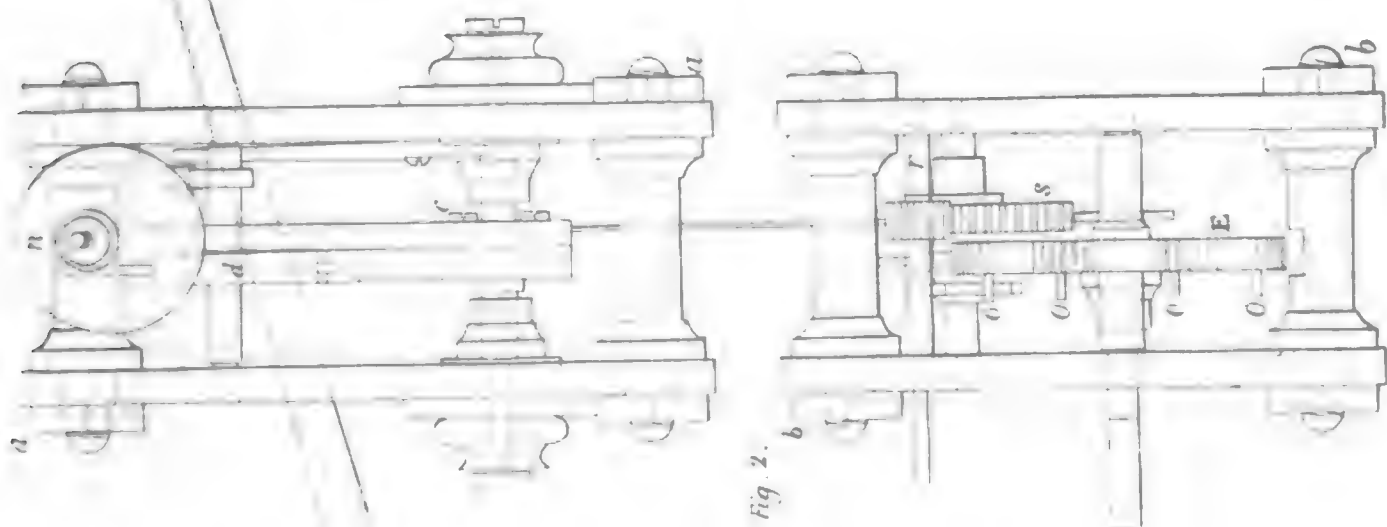
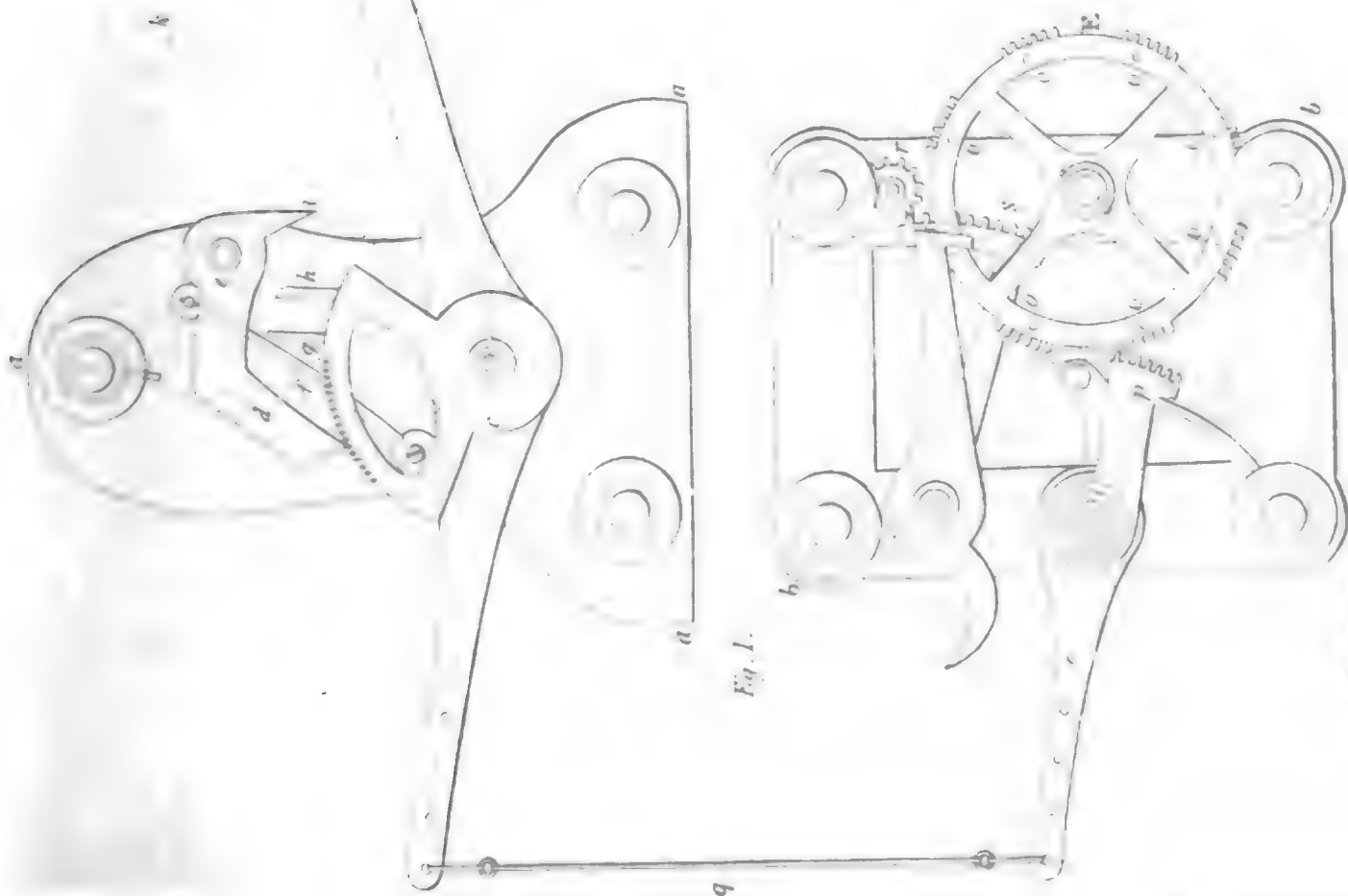
REFERENCE TO THE ENGRAVING.

Fig. 1 (Plate VI.) a front view.

Fig. 2 a side view. *a, a, a*, the frame containing the hammer-work. *b b* part of the striking part (the frame-plate in Fig. 1 being removed). *c* the axis of the hammer, having a ratchet or toothed segment attached to it. *d* a click, which acts in the ratchet. *e* (the dotted line) a heart-shaped wheel of brass, fixed on the same axis as the click. *f* a spring fixed by a screw at its lower extremity, and terminating at the upper in a roller, which keeps up a constant pressure on the projecting point of the heart-shaped wheel; and thus acts on the click so as to retain it between the teeth of the ratchet, or to hold it up out of contact with them according to the position of the wheel. *g* a pin fixed in the ratchet, which comes in contact with the inclined plane of the click as the hammer is drawn up, and throws the click up out of the teeth of the ratchet before the hammer arrives at its greatest elevation; at the same time, the heart-shaped wheel *e* having passed the roller at the head of the spring, holds up the ratchet. *h* another pin which comes in contact with the the tail *i* of the click, just before the hammer in its fall reaches the bell, driving the heart-shaped wheel back again past the roller, and dropping the click in the ratchet, so as to retain the hammer at any height to which it may rebound.

The dotted line *k* indicates the height of the hammer at its greatest elevation; and *l* the position to which it falls when in contact with the bell; and the position *m* of the hammer in the engraving shows the height to which it is thrown by the rebound.

Figs. 1 and 2, *n* the hammer-head; the shank of the
hammer





hammer is unavoidably drawn through the side view, Fig. 2, for want of room. E the compound-toothed sector to be applied to the pin-wheel of the striking-part; it has eight pins *o, o, o*, in it for the purpose of locking it at each fall of the hammer, which is necessary in the model to make it act properly.

Fig. 1, *p* the simple-toothed sector, in a position ready to act in the compound one when a power is applied.

Fig. 1, *q* is a wire which connects the model of the clock with the hammer, and draws it up when in action.

Figs. 1 and 2, *r* the pinion with two of its leaves cut out, which represents the axis of the motion wheel. *s* the toothed sector, which has a lever or detent fixed to its axis, which represents the lifting and locking detent of a clock, and which is raised by the motion of the pinion *r*, till it has revolved to the place where the teeth are cut out, and then lets it fall, and the striking part becomes released.

Fig. 3, a representation of the axis of the hammer at full size with the brass collars, and apparatus for preserving the pivots from rust. *t t*, parts of the frame-plates. *u u*, sections of two collets fixed in the frame, with the pivot holes in the centre, with a groove turned at *v v*. *w w*, two brass collars fixed to the axis of the hammer, which are formed as receptacles for oil, and which are turned to enter the groove *v v*, without touching it. *x x*, two screws which close the pivot holes at the ends to keep them air-tight.

The brass collet *u* is drawn out of the frame, and off the pivot of the hammer at the bottom of the plate, to represent those objects more clearly.

When

When I had the honour to lay my last communication relative to my improved hammer for turret clocks before the Society, I was labouring under indisposition ; and it was with some difficulty I was enabled to produce it in the state I did before the close of the session. I was consequently obliged to make my comparisons of resistance in the best manner I could by estimation, without having the means of making experiments on the subject. Having recently made an experiment on the resistance to the fall of the hammer, I think it necessary to communicate the same to you, especially as the result has turned out far more favourably to my new hammer than I expected.

I made the experiment on the hour-hammer of the turret clock at the Royal Military College, which weighs 12lbs. It has a perpendicular fall of three and a quarter inches ; the axis of the hammer is placed above the crown of the bell, and the head of it, when at rest on the counter-spring, forms an angle of about 50° below a horizontal line. I fixed a wire round the centre of gravity of the hammer-head, with a hook below it to suspend a weight on. I then lashed a quantity of bricks together, which I found on the roof of the building, and suspended them on the wire, and I found that the pressure of ten bricks weighing 66lbs. 4oz. did not overcome the resistance of the counter-spring, as I could just discern a space between the bell and the hammer, and the bell would sound when touched. The pressure of 66lbs. 4oz. on a lever inclined to the horizon in any angle is, as the co-sine of that angle to radius, which by estimating the angle of position of the hammer when the experiment was made at 50° below the horizon, will prove the actual resistance of the counter-spring to be equal to the pressure of 42lbs.

The

The whole force of percussion of a hammer of 12 lbs. falling perpendicularly three inches and a quarter, does not exceed the pressure of 50 lbs.; and out of that force the experiment proves that 42 lbs. is opposed by the resistance of the counter-spring, and only the force of 8 lbs. remains to put the bell in vibration. The hammer is lifted by an eight-day movement, with a maintaining power of 5 cwt. It is a clock made by one of the first makers, about ten years since, and is, I think, as fair an object for comparison as could be chosen.

After knowing the result of this experiment, it can be no longer a wonder that we hear such faint tones from most of our church clocks; for although machinery of great magnitude and heavy weights are employed in lifting the hammers, there is comparatively no force produced to put the bell in vibration. It is easy for any one to judge that the bells are not put in vibration, for none of the clocks produce that sound as is produced by ringing the same bell with a rope.

I beg to suggest, also, the impracticability of making a clock to go eight days, and to strike on a large-sized bell, so as to produce any effect. In fact, according to the present system, it has been found that so great a maintaining power is necessary for that purpose, as will grind the great wheel teeth to dust, before an eight-day piece will lift a hammer to put a large bell in vibration; and that will not be found strange to any person acquainted with the laws of mechanics, when it is considered that a hammer of twenty or thirty pounds weight has to be lifted 1248 times at once winding up the weight. With the new hammer, for which the Society has so liberally rewarded me, this is quite practicable, which will be the means of saving perpetually a great annual

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expense to the public, by requiring the attendance of a person only weekly, instead of daily, to wind it up; and an eight-day clock will perform more accurately than a thirty-hour one, as it will not be disturbed so frequently by the act of winding.

Even in thirty-hour clocks, where the bell is large, it is impossible to produce effect on the present system. I was walking at 150 yards distance from a church recently built, one evening within this month, in an open space, in the most favourable situation I could have placed myself when the clock struck nine; not a carriage moving, and the evening perfectly serene. I listened with the greatest attention to the striking of the clock, and there was one of the blows of the nine which neither I nor my companion could distinguish. The bell, from its sound, seems to be a particularly large fine-toned tenor, but the force of the hammer is not sufficient to put it in vibration. If my new hammer was applied to this bell it would increase the sound incalculably.

I will not attempt to give a minute calculation as to the increase of force which my new hammer is capable of producing, because the force of percussion of falling bodies, as compared with the pressure of gravity, and the resistance occasioned by friction, are neither of them capable of being discovered with mathematical exactness, yet it may be approached to something near the truth. According to the accompanying experiment, it appears that, by annihilating the resistance of the counter-spring the force will be increased to six times its present amount, as it will be increased from eight to fifty; which, multiplied by three (the increased force produced by extending the perpendicular fall, as stated in my former communication), will produce an increase of

of eighteen times the force as compared with that of the hammer of the clock at the Royal Military College and that too with only two-thirds the resistance of the draught of the hammer, the train being relieved from lifting it one-third of its draught. According to this theory, a maintaining power of one-eighteenth the weight when the new hammer is applied, will produce as much effect as is produced on the present system. If the great resistance of friction, which takes place by the employment of heavy machinery, pivots of large diameter, and large ropes, which are necessarily wanted to suspend the great weights on, be taken into consideration, it will be found to have been hitherto immense; and when it becomes generally known, that some of these resistances are annihilated, and others materially reduced, I trust that the new plan will be generally adopted, both in the manufacture of new church or turret clocks, and in those which are already in use, by exchanging their old hammers for new ones.

I cannot conclude this without stating, that the method of lifting the hammer with the compound-toothed sector is very convenient for the quarter part of clocks, as any number of hammers may be lifted with one compound-toothed sector.

Description

Description of an Apparatus for converting a Ship's Boat into a Life Boat. By HENRY GORDON, Esq. Capt. R. N.

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the ENCOURAGEMENT of ARTS, MANUFACTURES, and COMMERCE.

The Silver Vulcan Medal was given to Capt. GORDON for this Communication.

THE late shipwrecks that have happened, and the number of lives which have been lost, owing to the danger attending boats approaching a wreck in a gale of wind, with a high sea on, when they are not previously or expressly built or prepared for so perilous an enterprise, clearly prove the urgent necessity of adopting some means that may be found adequate to the accomplishment of so important an object.

The writer of this having paid some attention to the subject, and being thoroughly convinced that it is one of the greatest moment, has visited two ports (Bristol and Rye) where life-boats are kept, and has attentively examined them, and found them both so ponderous and so constructed, that he did not approve of either. He objects to the first, because an air-tight locker is one of the buoyant principles; to the other, because she was so very heavy that it must take a great many men to launch; to obviate, therefore, all these difficulties, and to make this kind of boat an appendage to every ship, whether merchant or man of war, he has drawn up the present observations, and submitted the accompanying draught, with a view to its being inspected by the Society of Arts, &c.; confident that it will be found to answer, because it has been submitted to experiment by the undersigned, who, on the 6th and 7th of December last, caused a
boat

boat at Millbank to be totally submerged, got into her in this situation, and floated. The buoyant principle was proportioned only for his weight, but the boat would have as easily floated with fifty persons or more on board, had the buoy been proportionably augmented; thus proving beyond a doubt, that the theory hereafter explained answers a practical purpose, even in the most extreme case. •

As simplicity and lightness of weight are the two principles on which the plan now presented is founded, it requires little reasoning to show how very essentially such a principle recommends itself to seafaring purposes, it being an indispensable requisite that a boat should not be one ounce heavier than is necessary, in order that she may be as portable as possible for hoisting in and out-board; and for being sent in the highest sea and the heaviest gale, to take up a drowning man, when fallen from the top-sail-yard, either by day or night.

The model of the boat in this draught is calculated to row six oars, which, with a coxswain and midshipman = eight men, triple this, = twenty-four, being the full compliment of men such a boat can contain, and then there will be scarcely room for the rowers to pull freely. The buoy is composed of prime Spanish cork, and consists of eight pieces or rows, each piece being a foot longer than that immediately below it. The pieces are connected to each other by strong cord, thus producing a degree of flexibility in the triangle sufficient to allow of its being closely applied to the boat's side, each layer occupying in breadth a streak of the boat. It farther possesses this great advantage, that it is not a fixture to the boat, but may be at any time removed; and when the boat is hoisted in-board or out, always can be un-shipped, so that the boat is intrinsically as light as ever; neither
would

would it be necessary to carry it on every occasion, yet it would be the safest way never to leave the ship without it.

It measures at the base one-third of the boat's length, and is supported by split canes or bamboo, tied together by strong cord well covered with shoemaker's wax. The pieces composing each individual row are secured by longitudinal layers of split bamboo or cane; and, being thus constructed, a blow that would stave in the boat, would not penetrate the triangle, owing to its elasticity.

Large boats, such as those capable of holding one hundred men, instead of being furnished with a single large triangle on each side, should have three of nine feet each in length; by which many advantages will be obtained. First, that the same triangles would serve for boats of different sizes, and hence the expense of the outfit be very materially reduced; secondly, triangles of the above dimensions are more manageable, easier put on or taken off, and more commodiously stowed away than larger ones. Thus the launch, rowing twenty-four oars, with seventy-five men on board, might be fitted in the following manner: the barge's triangle fixed a mid-ships, the cutter's on the bow, and the jolly-boat's on the quarter; the launch would then be rendered completely buoyant, without any additional expense.

The contrivance possesses at once these advantages: being extremely simple, affording the best security under similar circumstances, being so reasonable in its cost that it is within the reach of every merchant ship to supply herself at a small expense, and is particularly advantageous for the preventive service to approach vessels, and visit them when no other boat can; also, to be sent with dispatches to considerable distances in the open sea, on an emergency, provided the crew have sufficient provisions,

visions, to sustain them; to land at Deal, Yarmouth, Madras, and other beaches, when no other boat can; and to take up a drowning man in a gale of wind at sea when no other boat could live.

REFERENCE TO THE ENGRAVING.

Fig. 4 (Plate V.) shows the triangular buoy on a scale of three-eighths of an inch to one foot. Fig. 5 an end view; it is formed of pieces of cork one foot long, six inches wide, and about one inch and a quarter thick, laid three thicknesses together, and then placed end to end till of the required length (which is here nine feet for the upper streak), and then joined into one streak, by lengths of split cane laid on all four sides and sewed well together. The different streaks are fastened together by four ropes *q q*, *r r*, which are seised together between each streak; when used, the ends *s* are drawn under the keel till the lower streak touches it, and then brought up over the side and fastened to the thwarts; the two upper ends *q* and *r* are also brought over their side and fastened to the thwarts; the other triangle is drawn in like manner on the opposite side of the boat, and fastened. Fig. 6 shows the buoy attached to the side of a boat, on a scale of one-eighth of an inch to a foot. Fig. 7, an end view of a boat, shewing both the triangles lying close into the streaks. The triangle here represented diminishes one foot in each lower streak, the top one being nine feet, the next eight feet, and so on, each being six inches wide and about four inches thick (being made of three layers); two buoys thus made contain fourteen and two-thirds cubic feet of cork, weighing 226 lbs. 10 oz., and displace 944 lbs. 8 oz., of sea-water, leaving 717 lbs. 14 oz. of buoyancy, for a boat twenty-eight feet long, containing twenty-four men.

On the Cultivation of the Filbert, describing the Method of Pruning, as practised in the Grounds near Maidstone, in Kent. By the Rev. WILLIAM WILLIAMSON, A. M. Corresponding Member of the Society.

From the TRANSACTIONS of the LONDON
HORTICULTURAL SOCIETY.

THE county of Kent, and more particularly the district round Maidstone, and extending to the borders of Sussex, having been long celebrated for the production of large crops of filberts, and of a much larger size than are commonly grown, a description of the method of cultivation and pruning cannot be unacceptable to the Members of the Horticultural Society, more especially, as I have reason to believe it is but little, if at all, known in other parts of England.

In order to make myself more clearly understood, I shall treat the subject under the following divisions: *soil, raising the plants, manure, and pruning*; which last forms the great distinction between the cultivation in Kent and in other counties.

Soil.—The first consideration in making a plantation, is to select a proper soil; for if that be not congenial to the constitution of the plants, we cannot expect any great success. The soil in which the most experienced cultivators suppose the filbert to flourish best, is a *hazle-loam* of some depth with a dry sub-soil. If the sub-soil be too retentive of moisture, the trees are apt to run too much to wood, without throwing out those short twigs upon which the fruit is generally produced. That part of Kent where the filbert is chiefly cultivated is a loam, upon a dry sandy rock. As a general rule, that soil which is proper for the growth of hops is thought to be also congenial to the filbert.

Raising

Raising the Plants.—There are four methods of raising the plants: by suckers, layers, grafting, and sowing the nuts. Each is practised according to the peculiar object of the cultivator. The method adopted in the district above-mentioned is, by suckers; they come sooner into bearing, and make stronger plants than either layers or grafts. They are taken from the parent plant, generally in the autumn, and planted in nursery beds (being first shortened to ten or twelve inches), where they remain three or four years. They are slightly pruned every year, in order to form strong lateral shoots, the number of which varies from four to six. The most free growing plants are obtained by sowing the nuts; but they are so long in coming to a productive state, and are so much inclined to degenerate into inferior varieties, that this method is never resorted to in making a permanent plantation. The plants raised by laying and grafting are of more humble growth, and therefore better adapted for small gardens, where the economy of space is an object of importance.

Manure.—The filbert requires a considerable quantity of manure; the grounds in Kent are dressed every year, or at least once in two years. Every kind of manure is beneficial; but old woollen rags are found to produce the greatest effect. If Kent had not been a hop county, these would scarcely have been thought of; but as the same soil is congenial both to the filbert and the hop, it would soon occur to the intelligent cultivator, that probably woollen rags might be as beneficial to the filbert as they are known to be to the hop.

Pruning.—The method of pruning the filbert being so different from that of every other tree, as far as I know, and being not generally practised beyond the county of Kent, a particular explanation of it will be necessary.

Before any one can possibly prune a tree with propriety, it is necessary that he perfectly understand the mode of its fructification. The fruit of the vine is produced only upon shoots of the preceding year; cherries are grown chiefly upon short spurs emitted from the sides of the larger branches; if, therefore, the last year's shoots of the vine, or the spurs of the cherry-tree, are destroyed, there can be no fruit. Now, in some respects, the filbert is similar in its fructification to both these trees; the bearing branches being *always* those of the preceding year, similar to the vine, and those branches, if the tree be properly pruned, might with great propriety be called spurs, allowing for the difference between the filbert and the cherry. These short twigs or spurs are not more than a few inches long, every bud of which, in a good year, produces fruit. The great object of the following method of pruning is to cause the trees to throw out these spurs in great abundance; and when they are got to a proper bearing state, more than sufficient will be produced.

But though it is the usual practice to plant the suckers in nursery beds, I would advise every one to plant them where they are to remain, whether they are intended for a garden or a larger plantation; and after being suffered to grow without restraint for three or four years, to cut them down within a few inches of the ground. From the remaining part, if the trees are well rooted in the soil, five or six strong shoots will be produced. Whichever method is practised, the subsequent treatment of the trees will be exactly the same.

In the second year after cutting down, these shoots are shortened; generally one-third is taken off. If very weak, I would advise that the trees be quite cut down a second time, as in the previous spring; but it would be much

much better not to cut them down until the trees give evident tokens of their being able to produce shoots of sufficient strength. When they are thus shortened, that they may appear regular, let a small hoop be placed within the branches, to which the shoots are to be fastened at equal distances; by this practice, two considerable advantages will be gained; the trees will grow more regular, and the middle will be kept hollow, so as to admit the influence of the sun and air, but this, in a large plantation, would be almost impossible, nor indeed is it necessary, though in private gardens, where regularity and neatness are almost essential, it ought to be practised.

In the third year a shoot will spring from each bud; these must be suffered to grow till the following autumn, or fourth year, when they are to be cut off nearly close to the original stem, and the leading shoot of the last year shortened two-thirds.

In the fifth year several small shoots will arise from the base of the side branches which were cut off the preceding year; these are produced from small buds, and would not have been emitted, had not the branch on which they are situated been shortened, the whole nourishment being carried to the upper part of the branch. It is from these shoots that fruit is to be expected. These productive shoots will in a few years become very numerous, and many of them must be taken off, particularly the strongest, in order to encourage the production of the smaller ones; for those of the former year become so exhausted, that they generally decay; but whether decayed or not, they are always cut out by the pruner, and a fresh supply must therefore be provided, to produce fruit in the succeeding year.

The leading shoot is every year to be shortened two-thirds, or more, should the tree be weak, and the whole height

height of the branches must not be suffered to exceed six feet. Every shoot that is left to produce fruit should also be tipped, which prevents the tree being exhausted in making wood at the end of the branch.

The filbert is a monoecious plant, and consequently produces the male and female blossoms separately on the same tree. The slender scarlet filaments which are seen issuing from the end of the buds early in the spring, are the female, or productive blossoms; the barren or male blossoms are formed on long cylindrical catkins, which fall off as soon as they have performed their office. In pruning, care must be taken to leave a due supply of these to fructify the female blossoms, or our previous trouble will be entirely useless; this may be done without difficulty, for they are perfectly visible at the time of pruning.

The method of pruning above detailed might, in few words, be called a system of spurring, by which bearing shoots are produced, which otherwise would have had no existence.

It frequently happens that a strong shoot springs from the root; and should any of the first year's or leading branches be decayed, or become unproductive of bearing wood, it will be advisable to cut that entirely away, and suffer the new shoot to supply its place, which afterwards is to be treated in the same manner as is recommended for the others.

Old trees are easily induced to bear in this manner, by selecting a sufficient number of the main branches, and then cutting the side shoots off nearly close, excepting any should be so situated as not to interfere with the others, and there should be no main branch directed to that particular part. It will, however, be two or three years before the full effect will be produced.

But

But though this method of cultivation has long been celebrated, yet it does not appear to me so particularly successful as to deserve the encomiums which have been bestowed upon it; for though thirty hundred weight *per* acre have been grown in particular grounds, and in particular years, yet twenty hundred weight is considered a large crop, and rather more than half that quantity may be called a more usual one; and even then, the crop totally fails three years out of five; so that the annual average quantity cannot be reckoned at more than five hundred weight *per* acre.

When I reflected upon the reason of the failure happening so often as three years out of five, it occurred to me, that possibly it might arise from the excessive productiveness of the other two, the whole nourishment of the trees being expended in the production of the fruit; and that, consequently, they might be unable properly to mature the blossom for the following year. We know that peach and nectarine trees may be so pruned as to force them to bear a superabundant quantity of fruit in some one year; but we find that a regular crop in succession is thereby prevented, and that, too, for several years. In order to ensure fruit every year, I have usually left a large proportion of those shoots which, from their strength, I suspected would not be so productive of blossom buds as the shorter ones, leaving them more in a state of nature than is commonly done; not pruning them so closely as to weaken the trees by excessive bearing; nor leaving them so entirely to their natural growth as to cause their annual productiveness to be destroyed by a superfluity of wood. These shoots in the spring of the year I have usually shortened to a blossom bud, for the reason before given.

The great art of pruning is to produce the greatest quantity

quantity of fruit, without injury to the crop of the succeeding year, which, in my opinion, is not done by the Kentish method. But by observing the rule which I have laid down, though the trees do not *perhaps* bear so great a weight in any one year as by the method before detailed, yet the crops in the whole certainly are not less; with this great advantage both to the public and private grower, that a moderate but regular crop is ensured in every successive year. I think that by this plan the average weight in the whole will be greater. The year 1819 was a very productive one, and I grew two hundred weight of filberts (weighed when gathered) upon fifty-seven trees, the greater part of which were not above six years old (reckoning from the time of their being cut down), and growing upon three hundred and sixty square yards of ground, which is after the rate of twenty-seven hundred weight *per acre*; and upon part of the ground ten more trees are now planted, which, if they had come to a bearing state, would have increased the quantity to more than is considered as an extraordinary crop; besides having grown upon the older trees a moderate but regular quantity for several years preceding. I am the more confirmed in my opinion that the failure is caused by excessive bearing, by observing that there is very little blossom on my trees this spring, which has not been the case in former years.

In order to strengthen the tree as much as possible, care should be taken to eradicate the suckers from the root, which is effected by exposing the roots to a moderate distance from the stem, to the frosts of winter. The excavation in the spring is filled with manure.

As filberts are several years in coming to perfection, it is usual to plant hops, standard-apples, and cherries, among them, and when they come to a bearing state the
hops

hops are destroyed, and the fruit-trees suffered to remain. The ground is then planted with gooseberries, currants, &c. and an under crop of vegetables is likewise frequently obtained. If this were not practised, the crop of filberts alone, except in particular years, would not defray the expense. The distance at which filberts are planted, must depend upon their being mixed with other fruit.

I have been the more minute in my description, both that I might be clearly understood, and also that the directions might be generally useful; and I trust it will not be less acceptable on that account, for though the minutiae can only be practised in private gardens, yet the principle can be extended to any plantation, however large.

On Machinery for Calculating and Printing Mathematical Tables. By CHARLES BABBAE, Esq. F. R. S. Lond. and Edin. &c.

[This paper is drawn up from different private sources of information, but particularly from Mr. Babbage's printed letter on the subject, addressed to Sir Humphrey Davy, Bart.]

From the EDINBURGH PHILOSOPHICAL JOURNAL.

AMONG the brilliant inventions which have distinguished the present age, the machinery invented by Mr. Babbage for performing intellectual labour is entitled to a prominent place. Low as that species of mental exertion undoubtedly is when the mathematician performs the monotonous round of arithmetical calculations, in which neither the power of combination nor of judgment is called

called into action ; yet we were not prepared to see even these humbler functions placed under the surveillance of wheels and pinions ; and hence the first intelligence of a calculating machine has been received with as much incredulity by the wise as by the vulgar.

The object which Mr. Babbage had in view, in constructing this new machinery, was to produce printed copies of any mathematical tables, *without the possibility of an error existing in a single copy*. This result he proposed to attain solely by machinery, which at the same time made the calculations, and composed, with a proper type, the tables when computed. At the commencement, of course, of these operations, certain preliminary calculations must be made ; and at intervals the machinery must be set to these numbers ; but in some cases, when once set, the machine will continue working to the end of the tables.

In these contrivances there are two distinct parts, *viz.* one, by which the tables are computed, and the *other*, by which they are composed ; but, as the actual execution of such machinery requires a great expense, both of time and money, Mr. Babbage has contented himself with sketches on paper, accompanied by short memoranda, by which his contrivances may be at any time more fully developed ; and, when any new principles have been introduced, he has examined their actions by models executed on purpose. In order, however, to prove the practicability of these views, he has finished a small engine, by which the calculations are accomplished, and which has actually computed the following table, in which the second differences are constant.

Table

*Table computed by Mr. Babbage's Arithmetical Engine,
from the Formula $x^2 + x + 41$.*

41	131	383	797	1373
43	151	421	853	1447
47	173	461	911	1523
53	197	583	971	1601
61	223	547	1033	1681
71	251	593	1097	1763
83	281	641	1163	1847
97	313	691	1231	1933
113	347	743	1301	2021

The figures, as they are calculated by the machine, are not exhibited to the eye, as in sliding rules, and similar methods, but are actually presented to the eye on two opposite sides of the machine; the number 593, for example, appearing in figures before the person employed in copying. When the machine was engaged in calculating the preceding table, a friend of the inventor undertook to write down the numbers as they appeared. In the earlier numbers, the copyist, in consequence of writing quickly, rather more than kept pace with the engine, but as soon as four figures were required, the machine was at least equal in speed to the writer. At another trial, *thirty-two* numbers of the same table were calculated in *two minutes and thirty seconds*; and, as these contained *eighty-two* figures, the engine produced *thirty-three* every minute; another time it produced *forty-four* figures in a minute; and, as the machine may be moved uniformly by a weight, this rate of computation may be maintained for any length of time; and it is probable that few writers are able to copy, with equal speed, for many hours together.

Notwithstanding the defective workmanship in this
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first machine, its computations are wonderfully accurate; and some very skilful mechanics to whom Mr. Babbage has shewn it in confidence, are of opinion that it may be carried to any extent. Its parts, indeed, are few, but frequently repeated; and though it contains many wheels, yet only a few of them move at the same time, so that its simplicity is greater than that of many machines in common and constant use.

There is one circumstance in the construction of this machine, which is of considerable importance in making larger ones, viz. that, though its wheels are numerous, yet by a peculiar contrivance, any error produced by accident, or by a slight inaccuracy in one of them, is corrected as soon as it is transmitted to the next, and in such a manner as effectually to prevent any accumulation of small errors from producing a wrong figure in the calculation.

The machine for composing with types has not yet been actually constructed; but from several models which Mr. Babbage has made, and from numerous experiments which he has tried, there can be no doubt of its complete success*. When put up, the composing machine will contain about 30,000 types, which are put in their places by children; but the person who attends the engine has a method of ascertaining, in less than half an hour, *if any one individual of this number is misplaced.*

As the engine for computing tables by the method of differences, is the only one which Mr. Babbage has yet completed, he has, in his letter to Sir Humphrey Davy, confined himself to a statement of the powers which that method possesses; and as this statement is highly interesting, we shall give it in his own words:

* A working model of this part of the machinery has been recently constructed.

“ I would

“ I would, however, premise, that if any one shall be of opinion, notwithstanding all the precautions I have taken, and means I have employed to guard against the occurrence of error, that it may still be possible for it to arise, the method of differences enables me to determine its existence. Thus, if proper numbers are placed at the outset in the engine, and if it has composed a page of any kind of table, then, by comparing the last number it has set up with that number previously calculated, if they are found to agree, the whole page must be correct; should any disagreement occur, it would scarcely be worth the trouble of looking for its origin, as the shortest plan would be to make the engine re-calculate the whole page, and nothing would be lost but a few hours' labour of the moving power.

“ Of the variety of tables which such an engine could calculate, I shall mention but a few. The tables of powers and products, published at the expense of the Board of Longitude, and calculated by Dr. Hutton, were solely executed by the method of differences; and other tables of the roots of numbers have been calculated by the same gentleman on similar principles.

“ As it is not my intention, in the present instance, to enter into the theory of differences, a field far too wide for the limits of this letter, and which will probably be yet further extended, in consequence of the machinery I have contrived, I shall content myself with describing the course pursued in one of the most stupendous monuments of arithmetical calculation which the world has yet produced, and shall point out the mode in which it was conducted, and what share of mental labour would have been saved by the employment of such an engine as I have contrived.

“ The tables to which I allude, are those calculated under
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the direction of M. Prony, by order of the French government; a work which will ever reflect the highest credit on the nation which patronised, and on the scientific men who executed it. The tables computed were the following :

1. The natural sines of each 10,000 of the quadrant, calculated to twenty-five figures, with seven or eight orders of differences.

2. The logarithmic sines of each 100,000 of the quadrant, calculated to fourteen decimals, with five orders of differences.

3. The logarithm of the ratios of the sines to their arcs of the first 5000 of the 100,000ths of the quadrant, calculated to fourteen decimals, with three orders of differences.

4. The logarithmic tangents corresponding to the logarithmic sines, calculated to the same extent.

5. The logarithms of the ratios of the tangents to their arcs, calculated in the same manner as the logarithms of the ratios of the sines to their arcs.

6. The logarithms of numbers from 1 to 10,000, calculated to nineteen decimals.

7. The logarithms of all numbers from 10,000 to 200,000, calculated to fourteen figures, with five orders of differences.

“Such are the tables which have been calculated, occupying in their present state seventeen large folio volumes. It will be observed, that the trigonometrical tables are adapted to the decimal system, which has not been generally adopted even by the French, and which has not been at all employed in this country. But, notwithstanding this objection, such was the opinion entertained of their value, that a distinguished member of the English Board of Longitude, was not long since commissioned by

by our government to make a proposal to the Board of Longitude of France, to print an abridgment of these tables at the joint expense of the two countries; and £.5000 was named as the sum our government was willing to advance for this purpose. It is gratifying to record this disinterested offer, so far above those little jealousies which frequently interfere between nations long rivals, and manifesting so sincere a desire to render useful to mankind the best materials of science in whatever country they might be produced. Of the reasons why this proposal was declined by our neighbours, I am at present uninformed; but, from a personal acquaintance with many of the distinguished foreigners to whom it was referred, I am convinced that it was received with the same good feelings as those which dictated it.

“ I will now endeavour shortly to state the manner in which this enormous mass of computation was executed; one table of which (that of the logarithms of numbers), must contain about eight millions of figures.

“ The calculators were divided into three sections. The first section comprised five or six mathematicians of the highest merit, amongst whom were M. Prony and M. Legendre. These were occupied entirely with the analytical part of the work; they investigated and determined on the formulæ to be employed.

“ The second section consisted of seven or eight skilful calculators, habituated both to analytical and arithmetical computations. These received the formulæ from the first section, converted them into numbers, and furnished to the third section the proper differences at the stated intervals.

“ They also received from that section the calculated results, and compared the two sets, which were computed independently for the purpose of verification.

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“The third section, on whom the most laborious part of the operations devolved, consisted of from sixty to eighty persons, few of them possessing a knowledge of more than the first rules of arithmetic, these received from the second class certain numbers and differences, with which, by additions and subtractions in a prescribed period, they completed the whole of the tables above-mentioned.

“I will now examine what portion of this labour might be dispensed with, in case it should be deemed advisable to compute these or any similar tables of equal extent, by the aid of the engine I have referred to.

“In the first place, the labour of the first section would be considerably reduced; because the formulæ used in the great work I have been describing, have already been investigated and published. One person, or at the utmost two, might therefore conduct it.

“If the persons composing the second section, instead of delivering the numbers they calculate to the computers of the third section, were to deliver them to the engine, the whole of the remaining operations would be executed by machinery, and it would only be necessary to employ people to copy down as fast as they were able the figures presented to them by the engine. If, however, the contrivances for printing were brought to perfection and employed, even this labour would be unnecessary, and a few superintendants would manage the machine, and receive the calculated pages set up in type. Thus, the number of calculators employed, instead of amounting to ninety-six, would be reduced to twelve. This number might, however, be considerably diminished; because, when an engine is used, the intervals between the differences calculated by the second section may be greatly enlarged. In the tables of logarithms, M. Prony caused the differences to be calculated at intervals of 200, in order
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to save the labour of the third section ; but as that would now devolve on machinery, which would scarcely move the slower for its additional burthen, the intervals might properly be enlarged to three or four times that quantity. This would cause a considerable diminution in the labour of the second section. If, to this diminution of mental labour, we add that which arises from the whole work of the compositor being executed by the machine, and the total suppression of that most annoying of all literary labour, the correction of the errors of the press, I think I am justified in presuming, that if engines were made purposely for this object, and were afterwards useless, the tables could be produced at a much cheaper rate ; and of their superior accuracy there could be no doubt. Such engines would, however, be far from useless, containing within themselves the power of generating, to an almost unlimited extent, tables whose accuracy would be unrivalled, at an expense comparatively moderate ; they would become active agents in reducing the abstract inquiries of geometry to a form, and an arrangement adapted to the ordinary purposes of human society.

“ I should be unwilling to terminate this letter, without noticing another class of tables of the greatest importance, almost the whole of which are capable of being calculated by the method of differences. I refer to all astronomical tables for determining the positions of the sun or planets. It is scarcely necessary to observe, that the constituent parts of these are of the form $a \sin o$, where a is a constant quantity, and o is what is usually called the argument. Viewed in this light, they differ but little from a table of sines, and like it may be computed by the method of differences.”

“ Having thus given our readers a succinct description of the nature and objects of Mr. Babbage’s arithmetical machinery,

machinery, we have only to express our hope that the British government, or some of those institutions which it so liberally supports, will afford Mr. Babbage the means of constructing a large engine, and hold out to him some inducement to withdraw his attention from more alluring studies, and devote it to the completion of an invention which will do honour to his country, and to the age in which we live."

Mechanism applicable to Instruments for measuring Time, named a Vertical Regulator, or Régulateur à Tourbillon.

By M. BRÉGUT.

FROM DESCRIPTION DES BREVETS D'INVENTION.

THIS regulator may be adapted to every possible kind of escapement, on which it will uniformly produce its peculiar effect. This effect tends to correct all the anomalies due to the changes of position, of what nature soever they may be; for all the pieces to which the anomalies are due, passing in the space of every minute through all possible positions, a compensation necessarily takes place and annuls the errors.

The machinery being so arranged that the frame which carries the moveable system shall make one turn in a minute, it is possible to make the axis of this frame carry the seconds' hand.

The peculiar and distinguishing character of this invention essentially consists in this: the case of the watch being supposed fixed, the balance has, besides its oscillations or its motion backwards and forwards (occasioned by the action of the impulsion-wheel, and elastic force of the

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the spiral spring), a continued rotary motion round a fixed axis in respect to the case, proceeding from the moving power; so that the commencement of the oscillation of the balance is found at a given instant; noon, for example, to correspond with a certain point of the circumference of the fixed case; at one second, two seconds, &c. past noon, the commencement of the oscillation will correspond with different points. This is the principle of the compensations which the author wished to obtain.

A Machine for rendering the Variations of Temperature useful as a moving Power. By M. WOISARD.

From MEMOIRS of the SOCIETY of METZ.

THIS machine is composed of two vessels communicating by a vertical tube. The lower vessel is immersed in water. The upper vessel, exposed to the action of the solar rays, incloses a balloon, made of a flexible material, into which air with a small quantity of a very expansible liquid, such as ether, have been introduced.

It is obvious that if the atmospheric temperature falls, the balloon will diminish in bulk, the air surrounding it will become rarer, and the water will introduce itself into the lower vessels through a valve. If the temperature rises, the pressure exerted within the machine by the increase of volume of the balloon, will cause the excess of water to flow out.

According to the calculations of M. Woisard, if sulphuric ether be employed, and all the parts of the machine be of suitable proportions, it will raise to the height

of one metre as many times 500 litres (= 30514 English cubic inches), as there are cubic metres in the capacity of the upper vessel, whenever the temperature varies from 15 to 35 degrees of the centigrade thermometer, or from 59 to 77 degrees of Fahrenheit*.

M. FRANÇOEUR's Report, in the Name of the Committee of Mechanical Arts, on a Method of Compensation used in Watches. By M. DESTIGNY, of Rouen.

From the BULLETIN DE LA SOCIÉTÉ D'ENCOURAGEMENT.

With an Engraving.

CLOCKS which have a weight for the moving power, and a pendulum for the regulator, are the instruments the best suited for measuring the duration of time. When the wheel-work is well executed and the scapement easy, the friction is very little, and regular; and if the pendu-

* The different ethers are produced by the action of different acids upon alcohol. Gay-Lussac found the specific gravity of sulphuric ether 0.71192, at the temperature of 56.4 degrees of Fahrenheit. Under a pressure of 19.92 barom. it begins to boil at 96° F. Placed in contact with air, in a closed flask, it at length undergoes alteration and changes in part, according to M. Planche, into acetic acid. At the common pressure and temperature, water dissolves a tenth part of its weight of ether. Ether also dissolves a small quantity of water. No salifiable base combines with ether, except potash and ammonia. It unites with alcohol, forming a colourless clear liquid, decomposable by water, which unites with the alcohol, while the ether rises to the surface in small bubbles. Ether dissolves oils, resins, and India-rubber. It has but little action upon salts. Ether (*ether rectificatus*) is principally used in medicine, as a stimulant, diaphoretic, and antispasmodic. It is mentioned as early as 1540.—See Thenard's Analysis, pp. 94, 287, and 314.—Tr.

lum is disengaged from the effects of variations of temperature, a uniform motion may be expected. Watches are far from holding out the same promise. The size being much smaller, the execution of the wheel-work is more difficult. The spring which serves as a moving-power ought, in every degree of its tension, to exert the same force of developement; and yet these conditions, difficult to fulfil, are nearly without importance when it is considered that the alternations of temperature act powerfully on all its parts, and that the continual trepidation communicated to them by walking, breaks the regularity of the oscillations.

Of what importance is it not to obtain a perfect uniformity of motion in watches? They serve us in numerous cases where the carriage of a clock would be difficult or expensive; and it is moreover to marine watches that the safety of most navigators is intrusted. The most skilful workmen therefore have employed themselves in improving these valuable instruments. The care with which they are made leaves scarcely any thing to be desired, and it should be in particular endeavoured to conquer the temperature and the jogs occasioned by walking.

It is to remedy the first of these inconveniencies that M. Destigny has presented a paper to the Rouen Society of Emulation, which has honoured it with its approbation. To enable you to add yours, I think it proper to explain the method of compensation now in use, and to compare it with the method proposed by M. Destigny.

The regulator of the motion of watches is a spring as fine as a hair, bent into a spiral form, from which it derives its name. One end of the *spiral* is attached to the *cock*, an immoveable piece of the watch; the other end is fixed to the axis of a pivot, which is furnished with

two *pallets*, or teeth, which are pressed against alternately by the train of wheels. This pressure, by making the pivot turn, winds the spiral more round the axis, increasing the force which tends to unwind it. Arrived at a certain point, this tension makes the pivot turn backwards, by the unwinding of the spiral. By little and little the spring of the latter becomes weaker, till the pressure of the train of wheels overcomes this spring and the acquired velocity, and the pivot takes again its first motion. This pivot is loaded with a light circle called the *balance*, which increases its inertia. At each oscillation, a tooth of the scapement-wheel passes on one of the pallets; and if these vibrations are isochronal, the watch will have a uniform motion.

Besides, there are two supports made between, which the largest turn or coil of the spiral passes in one of its points, and against which it beats alternately. These supports, called the *fork*, carried by a moveable piece called the *rake*, serve to shorten the spiral as required for giving the vibrations the necessary duration.

Cold, by acting on the spiral and the balance, contracts them and increases their force of tension. It accelerates the vibrations of the balance and causes the watch to gain, unless the oil, by its congelation, destroys a part of the motion. It may be conceived that, by this two-fold effect, there may be possibly a natural compensation; and that, according as one or other shall predominate, there will be gain or loss of time. Hence the very different effect of temperature on the motion of watches; especially on those which are coarsely executed, such as the greater number of watches seen in commerce. We will here suppose that the watch is perfectly composed, that the friction is almost insensible, and the oil without effect: it is clear that cold will make it gain,
and

and heat make it lose time, precisely as it happens to pendulum-clocks.

To remedy this inconvenience *compensations* have been invented. Let us conceive two bars, one of steel and the other of brass (*cuivre*) soldered together in their whole length. It is known that steel will expand more than brass by heat; whence it will result that the bar of two metals will take a curvilinear form. Let there be fixed to the edge of the wheel without teeth, named the *balance*, little bars previously bent into an arc and formed of two metals. Terminate them by two balls of gold at their free extremity. The variations of temperature, by changing the curve of the compound metallic bars, will change the distance of the small masses from the centre of motion of the balance; and if the masses are properly disposed, there may be a compensation, because the cold, by increasing the force of the spiral, will tend to produce more rapid vibrations; but it will remove the masses of gold to a greater distance, and they will act on the centre by a longer lever, and this will tend to make the oscillations slower. These gold weights being made to screw on their bars, it is possible to vary their distance along those bars. By repeated trials they are screwed to the exact point where a compensation is observed to be produced. This compensation must have place in every position of the watch and at every temperature; but this is never obtained but in an imperfect manner.

Instead of applying the compensation to the balance, M. Bréguet has thought of making it act on the spiral. This spring beats, in its excursions, between the two branches of the fork. If these limitary points move with the rake which carries them, the length of the spiral will change, which will produce a change in the duration of the

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the vibrations. The object in question is to lead these variations by those of the temperature.

Let us conceive a straight slip formed of two pieces, one of steel and the other of brass, soldered together lengthwise. Let us bend this slip into the form of two parallel branches, which might also be bent into concentric arcs, that it might occupy less room. One of the ends is fixed to the plates, the other is free and bears lightly on the spiral, near the bearings of the rake. Heat, by altering the form of this double bi-metallic arc, will change the point of contact with the spiral, without confining it. Hence will result a variation of the length of the spiral according to the variation of temperature, and if the proportion of the parts be suitable, there will be a compensation. It is never obtained but approximately by this method, which is far from being equal to the preceding, and which M. Bréguet uses only in watches of the second order.

M. Destigny, aware that the principal difficulty met with in this contrivance was the producing of exact compensation, has had the happy idea of placing the free extremity of the double bi-metallic arc, not on the spiral, but on one arm of a bent lever, which is itself placed on the spiral. The fixed end of the compensation-piece is not attached to the plate of the watch, but to a moveable piece which allows its position to be changed with regard to the bent lever. The result of this arrangement is the greatest facility of making trials. The watch is subjected to extreme temperatures, and if it be regulated in one of these states at zero, for example, and if it be observed that in the opposite state the watch loses time, it may be concluded that the spiral was too short in the second trial, and by a slight change in the place of the compensation-piece, and new trials, the desired effect will soon be obtained.

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This method has besides the advantage of avoiding one of the greatest inconveniencies of compensations. When the oil becomes thick, and in a long voyage, this can scarcely fail to occur more or less, the compensation in general no longer obtains by any of the known means. The relation of the parts must be changed; trials made; in short it is necessary to proceed as at first, which cannot be done except by a skilful artist. But it is so easy to displace the compensation-piece of M. Destigny, that every intelligent watch-maker may re-adjust the compensation. Indeed, the mechanism is similar to that which commonly serves for regulating the time in all sorts of watches.

It is needless to say that this system of compensation can never be adapted except to chronometers, constructed with the greatest care, furnished with a suitable escapement, and the pivots of which turn in jewelled holes. Other watches offer so many causes of irregularity, that it would be useless to remedy the effects of temperature; which are not in this case the most considerable.

Description of the System of Compensation.

A, Fig. 2, (Plate V.) represents the cock; C C the balance; B B the lower ratchet, fixed on the cock, and having its centre of motion confounded with that of the balance. On this ratchet is fixed in *o* the piece *m, n, o*, broken at the point *n*, by means of a pin, which forms a kind of hinge: the extremity *m* of this lever can be opened or closed, and consequently removed from, or brought nearer, the screw *u*, carrying an eccentric pin, the use of which we will explain. The little spring *P* tends to press the end *m* of the lever from *u*; *i* H is a portion of a circle, with divisions, which forms a part of the

the ratchet B B; another ratchet, *c* D, is adjusted on the first, having, like that one, its motion concentric with that of the balance. Ont his ratchet is fixed, in *q*, the compensation-piece *q, r, s*, so that the extremity *s* bears on the lever *m n*; L L is the spiral-spring, fixed at K, and its outer spire passes between the point *n* and the end of the lever *m n*; F G is an arc of a circle, with divisions, which are made to be passed over at pleasure by the extremity of the ratchet, in order to make the watch gain or lose. When the respective position of the two ratchets is determined, the notched part of the upper one serves to fix them together by means of a screw, seen on the lower ratchet; *tt* are two eccentric screws, for preventing the two ratchets from rising. In the execution it is essential that the part *m n* of the lever be perfectly concentric, so that, by carrying alternately the extremity *s*, of the compensation-piece upon all parts of the lever, and moving the ratchet towards *i* or H, the extremity *m* of that lever shall have no motion, it being understood that this operation is performed at a fixed temperature.

Fig. 3 represents the same system, seen underneath.

These two figures are drawn half the real size of the parts.

Effects resulting from this System.

First of all, the watch must be exposed, by means of a stove, to a temperature at least equal to that of the fob, and examined, in that state, whether the spiral-spring has the proper play between the points *m u*: this play ought to be the smallest possible, without, however, confining the spiral. It is regulated by means of the screw *u*, which carries the eccentric pin. It is unnecessary to observe, that it is essential to bend the last turn of the spiral, included in the space passed over by the ratchet, so

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as to form exactly the same arc as that described by the the small interval mu , by varying the ratchet. Now, let us suppose that the temperature of 25° centigrade ($=46^{\circ}$ F.), and in the position occupied respectively by the two ratchets, Fig. 3, the watch is regulated, and that suddenly the temperature falls to 0° ($=32^{\circ}$ F.), the watch, agreeably to what we have said of the effect of cold on the balance and spiral, should gain; but, at the same time, the compensation-piece, q, r, s , closing, will permit the extremity m of the lever to recede from the pin u , which will augment the space in which the spiral passes, and consequently should retard the vibration: if the quantity of variation produced by each of these two contrary effects be the same, an exact compensation will be established. In the contrary case, if the compensation be too much or too little, it may be rendered perfect by increasing or diminishing the effect of the compensation-piece, which can be done by changing its position relatively to that of the lever, moving the extremity of the ratchet $e D$ towards H , to render the compensation greater, and towards i to diminish it, according as observations on the going of the watch require.

It may be remarked, that this operation can be readily performed, even by the owner of the watch. A few months after the watch has been cleaned there will be an increase of friction, from the alteration of the oil, which would render the compensation too great. By this system it may be re-established exactly, by moving the compensation-piece towards the point m of the lever the quantity discovered by observation to be necessary.

*Infringement of Patent Right.**Court of King's Bench, Guildhall, Dec. 17, 1823.*

SAVORY v. PRICE.

THIS was an action by Mr. Savory, an eminent chemist, in Bond-street, to recover damages sustained in consequence of the infringement of his patent for the manufacture of Seidlitz Powders, by Messrs. Price and Son, chemists, of Leadenhall-street.

Mr. Scarlett stated the case on behalf of the plaintiff, who, in 1815, took out a patent for the manufacture of Seidlitz Powders, possessing the medicinal properties of the celebrated Seidlitz spring in Germany. The value of those waters was acknowledged by the chief physicians on the Continent, and the powders were well known to produce salutary effects of a similar nature and degree. Mr. Savory, who exported large quantities of the powders, discovered that Mr. Price had largely manufactured them, had inserted the word "improved" for patent, and had exported them at an inferior price. Under these circumstances, he called on the jury to protect him in the enjoyment of property to which he had an exclusive right, but which tended essentially to the benefit of the public.

The patent and specification were then put in evidence. (Which specification is published in our twenty-ninth volume). The latter contained, of course, a development of the manner in which the composition was made: It comprised three recipes of much apparent complexity, and applicable to very large quantities of the different ingredients.

Mr.

Mr. Thomas Gregory Briggs was then examined by Mr. Gurney.—He described himself as clerk to the plaintiff and his partners, Messrs. Moore and Davidson, by whom the Seidlitz Powders were manufactured and sold at 4s. 6d. a box, on which there was a stamp duty of 6d. On April 13, in last year, he went to the shop of the defendants in Leadenhall-street, and inquired for a box of Patent Seidlitz Powders, which he received from Mr. Price, jun. and for which he paid 4s. 6d. He produced the box marked “ Patent Seidlitz Powders, sold by Price and Co.” On this occasion he asked Mr. Price for what he would sell a quantity for exportation; to which Mr. Price replied, that as he shipped a great quantity for the East and West Indies, he could afford to sell wholesale at 30s. a dozen; and as he then only fixed a three-penny stamp, there was at once 3s. a dozen saved. He went again on Wednesday, the 17th of April, when he first saw the shopman, and then young Mr. Price. He asked for another box of the Patent Seidlitz Powders, and received a box, apparently the same as before, except that the word “ improved ” was substituted for the word “ patent.” He paid 4s. 6d. for it, and brought it away. On the following day he went again, and saw Mr. Price, jun. and observed that the last box was not the same with that which he had before, because of the different endorsement; Mr. Price said they were exactly the same; he, witness, however, said he was not satisfied that they were the same as Savory’s, and asked who Savory was: he said, Savory, of Bond-street, who had a patent for these powders; he did not like to sell any more as patent, to injure Savory. He then asked for a label, such as was on the boxes, called “ patent;” Mr. Price objected to this, but assured the witness they were precisely the same, and he might take them without fear. He also stated they were, in every respect, the same as Savory’s. He gave

gave the boxes to Mr. Faraday, of the Royal Institution, to analyze, and received them back from him.

Mr. Faraday, chemical assistant to the Royal Institution, said he analyzed the two boxes of Seidlitz Powders given to him by the witness Briggs. They were both as much alike as such preparations could be. He also analyzed a box given to him by Mr. Savory, and found it to be the same as the defendant's. He had examined the specification, and found that it would enable a practical chemist to produce those powders, and that the powders corresponded with the description.

On cross-examination, Mr. Faraday said the properties in Mr. Price's box were the same as those in the specification. He had not analyzed the Seidlitz waters, nor knew any one who had; one great authority said they contained muriate of magnesia, the other held the contrary. All the authorities agreed that they contained sulphate of magnesia, which is called Epsom salts. There was no sulphate of lime in the specification; there was in the waters. With the exception of soda, there was no ingredient in the powders which was contained in the waters; how far the medicinal properties of the two might be similar, he could not say; the chemical properties were unquestionably different. The result of the first recipe in the specification was Rochelle salts; the result of the second recipe, bicarbonate, formerly called supercarbonate of soda; the result of the third recipe, tartaric acid. Rochelle salts were known previous to the patent; tartaric acid was always produced by the means set forth; and supercarbonate of soda might have been procured at the chemists before 1815 in a perfect form. Before that time it was not unusual to mix an acid with an alkali in order to produce an effervescent draught.

The Lord Chief Justice. — If I were to take two scruples

ples of Rochelle salts, two scruples of tartaric acid, and two scruples of supercarbonate of soda, and mix them together, would they not produce exactly the same result as this elaborate process?

Mr. Faraday replied, they certainly would produce the same result. He did not know that tartaric acid was sold in the shops by that name before 1815. Chemical names often underwent changes, and they were often used in the laboratory long before they were introduced into shops, or even used in medical treatises. On looking at the specification, Mr. Faraday said, that the same results might be produced though the proportions of the ingredients were different; but then there would be a *residuum*, which it would be necessary to separate. The mode pointed out of producing tartaric acid was not the best, nor that which was now usually adopted.

The Lord Chief Justice expressed a strong opinion, that the patent could not be supported. It was the duty of every patentee to set forth in his specification, in the plainest and most intelligible language, the manner of composing the article in question. Now it appeared that the union of three common ingredients, to be obtained by any man in any chemist's shop, would produce these powders; why, then, was there all this elaborate mystery?

Mr. Scarlett submitted, that as chemical names were fluctuating, it was right for the patentee to set forth all the simple ingredients in his medicine, to prevent future errors.

The Lord Chief Justice said, that whatever fluctuation there might be of names, the patentee was bound to explain his process to the common apprehension of mankind as far as possible; and in this case a different course had been taken.

Mr. Scarlett begged leave, before the cause was decided,

cided, to ask a few questions of Dr. Powell. That physician was accordingly called, and stated, that in 1809 he translated the London *Pharmacopæia*, and then tartaric acid had no place there by that name. Before 1815, bicarbonate of soda and Rochelle salts were commonly sold. He knew the Seidlitz Powders practically. To him the combination was new, and it was certainly convenient and useful. If you took two scruples of supercarbonate of soda, two scruples of Rochelle salts, and two scruples of tartaric acid, and dissolved them in half a pint of spring water, they would produce the same result as the Seidlitz Powders.

The Lord Chief Justice.—Then I am clearly of opinion that the plaintiff must be nonsuited. He was bound to set forth the plainest and simplest mode of manufacturing his invention; he has not done so; and he cannot sustain an exclusive right to sell it.

The plaintiff was accordingly nonsuited.

List of Patents for Inventions, &c.

(Continued from Page 64.)

JOSEPH BOURNE, of Derby, Derbyshire, Stone-bottle manufacturer; for certain improvements in the burning of stone-ware and brown-ware in kilns or ovens, by carrying up the heat and flame from the furnace or fire below to the middle and upper parts of the kiln or oven, either by means of flues or chimnies in the sides thereof, or by moveable pipes or conductors to be placed within such kilns or ovens; and also by increasing the heat in kilns or ovens by the construction of additional furnaces or fires at the sides thereof, and to communicate with the centre or upper parts of such kilns or ovens; and also by conveying

conveying the flame and heat of one kiln or more into another, or others, by means of chimnies or flues, and thus permitting the draft and smoke of several kilns or ovens to escape through the chimnies of a central kiln or oven of great elevation, whereby the degree of heat is increased in the several kilns or ovens, and the quantity of smoke diminished. Dated November 22, 1823.

JOHN SLATER, of Saddleworth, Yorkshire, Clothier; for certain improvements in the machinery or apparatus to facilitate or improve the operation of cutting or grinding wool or cotton from off the surfaces of woollen cloths, kerseymeres, cotton cloths, or mixtures of the said substances; and for taking or removing hair or fur from skins. Dated November 22, 1823.

THOMAS TODD, of Swansea, South Wales, Organ-builder; for an improvement in producing tone upon musical instruments of various descriptions. Dated November 22, 1823.

SAMUEL BROWN, of Windmill-street, Lambeth, Surrey, Gentleman; for an engine or instrument for effecting a vacuum, and thus producing powers, by which water may be raised and machinery put in motion. Dated December 4, 1823.

ARCHIBALD BUCHANAN, of Catrine Cotton-works, partner with James Finlay and Co. Merchants, Glasgow; for an improvement in machinery heretofore employed in spinning-mills in the carding of cotton and other wool, whereby the top cards are regularly stripped and kept clean by the operation of the machinery, without the agency of hard labour. Dated December 4, 1823.

JOSIAH PARKES, of Manchester, Lancashire, Civil Engineer; for a certain method of manufacturing salt. Dated December 4, 1823.

GEORGE MINSHAW GLASCOTT, of Great Garden-street,

street, Whitechapel, Middlesex, Brass-founder, and **TOBIAS MICHELL**, of Upper Thames-street, London, Gentleman; for certain improvements in the construction or form of nails to be used in or for the securing of copper and other sheathing on ships, and for other purposes. Dated December 9, 1823.

THOMAS HORNE the younger, of Birmingham, Warwickshire, Brass-founder; for certain improvements in the manufacture of rack pullies, in brass or other metals. Dated December 9, 1823.

WILLIAM FURNIVAL, of Droitwich, Salt-manufacturer, and **ALEXANDER SMITH**, of Glasgow, Master Mariner; for an improved boiler for steam-engines and other purposes. Dated December 9, 1823.

Sir HENRY HEATHCOTE, of 23, Surrey-street, Strand, Middlesex, Knight, and Captain in the Royal Navy; for an improvement of the stay-sails generally in use, for the purpose of intercepting wind between the square-sails of ships and other square-rigged vessels. Dated December 13, 1823.

JARVIS BOOT, of Nottingham, Nottinghamshire, Lace-manufacturer; for an improved apparatus to be used in the process of singeing lace and other purposes. Dated December 13, 1823.

PIERRE JEAN BAPTISTE VICTOR GOSSET, of Queen-street, Haymarket, Middlesex, Merchant; for a combination of machinery for producing various shapes, patterns, and sizes, from metals or other materials, capable of receiving an oval, round, or other form. Communicated to him by a certain foreigner residing abroad. Dated December 18, 1823.

THE
REPERTORY
OF
ARTS, MANUFACTURES,
AND
AGRICULTURE.

No. CCLXI. SECOND SERIES. Feb. 1824.

Specification of the Patent granted to JOHN HUGHES, of Barking, in the County of Essex, Slop-seller; for certain Means of securing the Bodies of the Dead in Coffins. Dated September 11, 1823.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Hughes do hereby declare that my said invention, of certain means of securing the bodies of the dead in coffins, is fully described and ascertained in manner following, and by the drawings in the margin of these presents, and accompanying description thereof; that is to say: My invention consists in the use or application of an extra, or additional bottom or bottoms to the coffin, and fastening thereto the body, by means of plates, chains, bars, springs, or straps, of cast or wrought iron, steel, or any kind of metal, joined together or separate, as may be most desirable; and attaching or firmly affixing the said extra bottom or bottoms with

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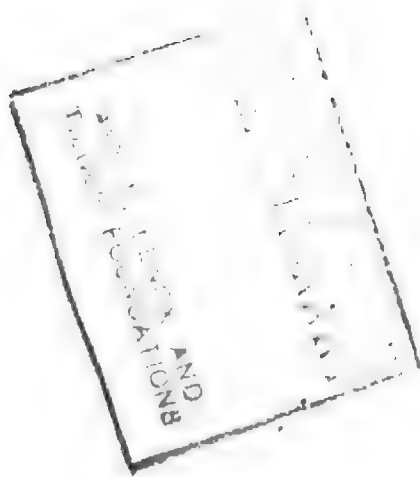
the body thus fastened or held down to the usual and real bottom of the coffin, or to the sides thereof, by means of locks, springs, catches, bolts, nuts, and screws, nails, or rivets, as may be most convenient.

Note. — This extra or additional bottom or bottoms to the coffin may be made of wood, iron, steel, or any kind of metal; but if made of wood only, it is desirable that it should be bound or strapped with iron, to guard it from being cut.

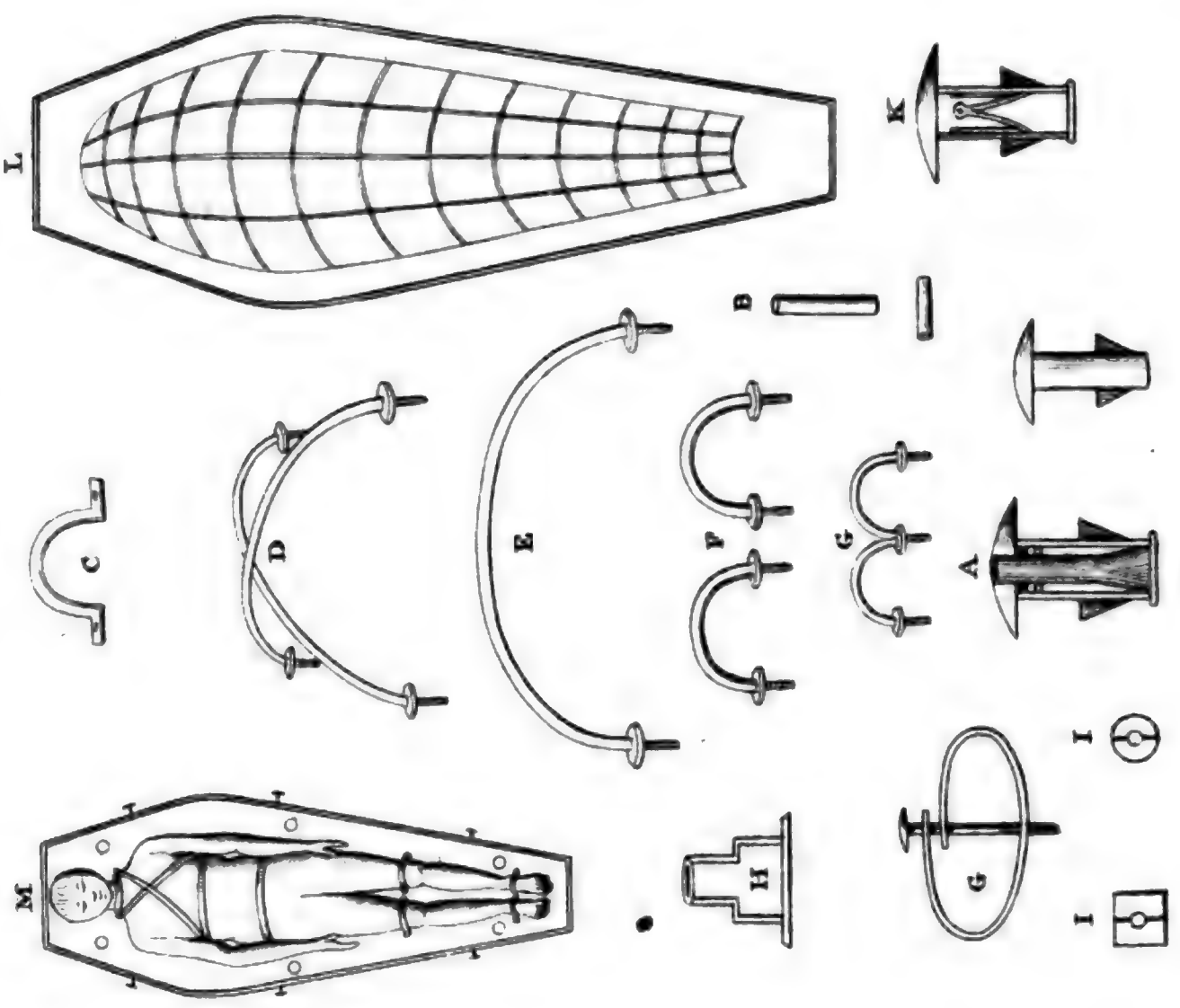
The drawings in the margin of these presents exhibit the kind of plates, chains, bars, springs, or straps, by which I propose to fasten or hold down the body to the extra or additional bottom or bottoms, or sides of the coffin, and the means of fastening the same to the usual or real bottom or bottoms and sides; though it must be understood I do not mean to confine myself to these precise kind of fastenings, or to use the whole number at any one time, except on particular occasions.

DESCRIPTION OF THE DRAWINGS.

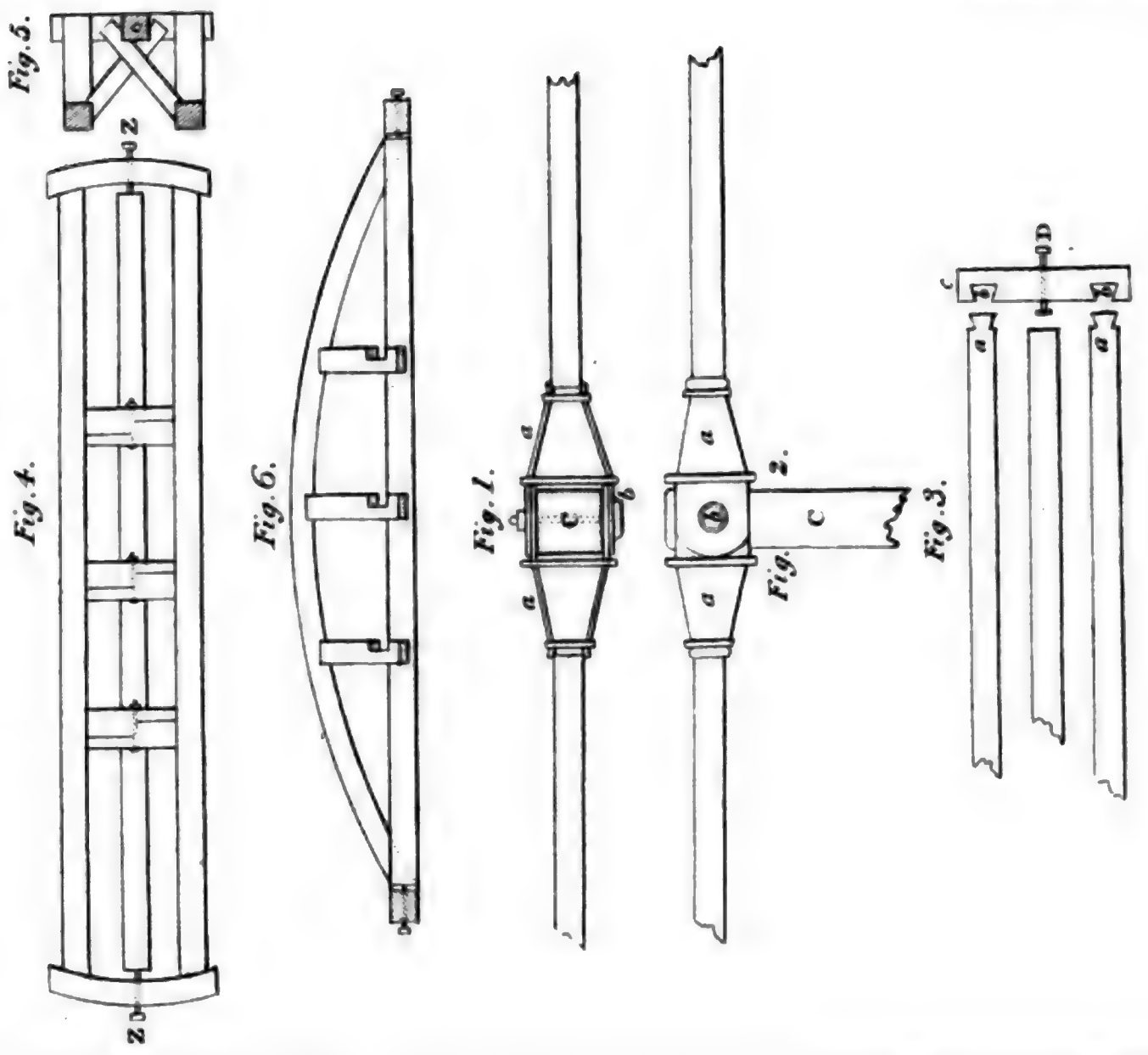
A (Plate VII.) is the peg that fastens the bottoms together by being introduced into the socket of H, which is screwed or rivetted to the real or original bottom of the coffin. B, the pins to be driven through the hole in the top of the peg A, which force out two or more catches into the socket, and are fastened by a shoulder, which is within the socket H. K is another peg, with a spring to force out the catches, as before mentioned. C is a collar or strap, to be put on the neck of the corpse. D, two straps, the one end of each to go through the holes in the neck-strap, to be secured to the extra bottom of the coffin with nuts and screws on the
undermost



Mr. Hughes' Patent.



Mr. Gladstone's Patent.



undermost side: the other ends of these straps are to go under the arms of the corpse, and through the extra bottom of the coffin, and screwed as before mentioned. E, the body-straps, fastened in the same manner as the straps D. F and G are straps for the knees and ancles, to be fastened to the extra bottom of the coffin with nuts and screws, in the same manner as the other straps are secured to the extra bottom or bottoms of the coffin. I, a nut, either square or round, to screw on to the straps, and to fasten them to the extra bottom of the coffin. L, a number of straps, rivetted or welded together, to form a grating or cage, to cover the corpse from head to foot, and fastened to the extra bottom or bottoms, or to the sides of the coffin, with nuts and screws, as before mentioned. M, the extra bottom of a coffin, shewing the body or corpse secured by the fastenings above described.

In witness whereof, &c.

Specification of the Patent granted to JAMES GLADSTONE, of Liverpool, in the County of Lancaster, Ironmonger; for a Method of increasing the Strength of Timber.

Dated September 20, 1821.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said James Gladstone do declare that the nature of my said invention, and the manner in which the same is to be carried into effect and performed, is described as follows; that is to say: My method of increasing the strength of timber intended to be used in the construction of bridges, beams, rafters, and roofs of buildings,

buildings, is by trussing and combining them together in the following manner : For constructing bridges, I place longitudinally, and join together, by means of iron fastenings, as represented in Figs. 1 and 2, (Plate VII.) which will be more fully described hereafter), as many pieces of timber as will be necessary to reach from one abutment or pier to another ; the ends of which I properly secure, and draw the timber so connected to the tension or tightness I desire, forming thereby a catenarian curve between the piers or abutments ; and, according to the width of the road or way I desire to make, I place as many of these combined timbers parallel to each other, and on the same plane, as I think necessary. From the joints of each timber so connected I suspend other timbers of various lengths, to the lower ends of which I secure horizontal timbers, in order to form the road-way. For the purpose of constructing beams, rafters, and other parts of buildings, I take three pieces of timber, all of them the required length and scantling, and place them either close together, side by side, or a little distance apart ; and at the ends of the two outermost, see *a a*, I cut dove-tails, to fit into corresponding mortises *b b*, cut into and near the ends of two short cross pieces *c*, as shewn at Fig. 3, through the middle of each a powerful screw, *D*, having been placed. I then subtend the middle timber, by means of the screws acting on the ends (previously prepared with iron) of the middle timber, as shewn at *Z Z*, Fig. 4, which causes the two end pieces to belly, and press upon the ends of the two outside timbers, thereby causing them to rise or camber upwards in the middle. I then wedge up the ends of the middle timber (or the screws may be left in), and I proceed to brace the three timbers in their places, as shewn in the sections, Figs. 5 and 6.

In

In Figs. 1 and 2 are represented plates of iron, *a a*, properly secured to the ends of each longitudinal timber, having such a corresponding hole through them to receive the pin *b*, so as to form a joint. Likewise, in Figs. 1 and 2 is represented the perpendicular or suspended timber *C*, destined to support its part of the road, by having at the lower end a mortise to receive the cross timbers to form the road. In witness whereof, &c.

Specification of the Patent granted to JOHN FROST, of Finchley, in the County of Middlesex, Builder; for a new Method of casting or constructing Foundations, Piers, Walls, Ceilings, Arches, Columns, Pilasters, Mouldings, and other Enrichments to Buildings.

Dated September 27, 1822.

TO all to whom these presents shall come, &c.
NOW KNOW YE, that in compliance with the said proviso, I the said John Frost do hereby declare that my said invention consists in casting or constructing foundations, piers, walls, ceilings, arches, columns, pilasters, mouldings, and other enrichments to buildings, so that the same may be finished at once in their places as the work proceeds; for which purpose, I first construct moulds in convenient sizes, either of wood, metal, or other substances, with a finished face, either plain or enriched, exactly the reverse or counterpart of the work designed to be executed; which moulds are to be firmly fixed by the means of proper supports and braces, as their intended situations may require, so as to bound exactly the surface or the part of the surface of the intended work; and all void spaces through which the materials to be used in the work can ooze must be stopped with putty or other soft substance. I make as few of the moulds answer the purposes

purposes of the intended work as I possibly can, by removing them as the correspondent parts of the work become set and solidified, and refixing them in the other parts of the work in progressive continuation as the nature of it will permit. I divide the surface of a circular ceiling or arch into parallel compartments, extending from abutment to abutment; I also divide or subdivide domes or spherical ceilings into compartments, and use three or more moulds at a time for similar compartments; and when the correspondent parts of the work, supported by their surface, become set and solidified, I remove the middle mould only, and refix it in continuation as before described.

I also divide or subdivide the surface of ceilings into compartments, with iron ribs (such ribs being strong enough to support flooring or roofing when required), the bottom parts thereof being furnished with small rims or mouldings to receive and support the compartments of the ceilings. The face of each mould must, before it be used, be covered or smeared over with some substance, which will prevent any adhesion thereto of the materials to be used in the construction of the work, and which substance will not act chemically either upon the materials or the moulds; for example, when plaster of Paris or prepared gypsum is used for the face of the work, I use grease or oil; when other quicksetting calcareous cements are used, fine linen or other cloth, or paper, or thin glue, or thick size applied warm, and suffered to cool before the mould be used. The required works are then formed by using hard and durable substances imbedded in such calcareous cements as will set quickly and without shrinking, and will harden in a short period, such as Roman cement, Dobb's patent cement, my British cement, Lorient's composition mortar, or calcined gypsum,

gypsum, or plaster of Paris. For aquatic purposes, or damp situations, I select such as will readily set and harden under water; and for all external works, such as will bear the vicissitudes of the weather. For ceilings and cornices and their enrichments, which require a fine face, I mix as quickly as possibly a small quantity of plaster of Paris with water to a creamy consistency, and instantly apply a thin coat with a soft brush to the face of the mould, fixed and prepared for use as aforesaid; and in the mean time another small quantity of plaster or other cement having been quickly tempered with water to the consistence of mortar, I apply it with a trowel as a thicker coat at the back of that first applied with a brush, and then instantly fill up the body of the work with cement, in which bricks, tiles, or squared stones are introduced in regular courses; or in which bricks, tiles, stones, clean worked gravel, ballast, or shingle, or other hard and durable substances are introduced, and heterogeneously incorporated; but in such manner that the cement may be in sufficient quantity to retain the distinguishing properties before enumerated.

For walls, columns, pilasters, and other enrichments to buildings, the cement is to be tempered with water to the consistency of thin mortar, and applied and supported with a trowel to the prepared face of the mould, and the body of the work instantly formed as before described; and after the moulds are removed, and the cement has acquired firmness without being too hard, I remove any little inequality of surface, and smooth the same with a trowel or handfloat, using water and a little tempered cement when necessary, in the manner plastered surfaces of walls are usually finished. In casting foundations and rough walls, I fill in the body of the work at once, omitting the fine coats. In constructing foundations

foundations of walls and piers, the parts of which may be under water, I mix the required cement with the before-mentioned hard and durable substances, and convey it from above the surface of the water in boxes or bags, and discharge it at the surface of the work under the water; or I discharge it through perpendicular canvas or other tubes a few inches in diameter, supported by a temporary level frame or open platform, and by moving the upper end of the tubes horizontally, the composition is regularly and gradually deposited in a soft state, which quickly hardens to a strong and durable conglomerate rock; or I inclose the composition in bags lowered by tackle to the surface of the work, and there dispose them in a regularly stratified manner while the composition is in a soft state, and will take the impression of the preceding layer or strata, and thus form rough courses of a well imbedded conglomerate rock. When necessary to give a smooth face to work below water, I drive piles, and make a frame work or mould round the same in the manner before described as to buildings. In constructing foundations with the compositions inclosed in and left in bags, as lastly herein-before described, no framework is necessary, and slower setting cements may in some situations be used, such as terras and puzzolano mortars.

I intend to confine my said patent to the casting or constructing the parts of buildings and their enrichments as aforesaid in their places, and not to extend it to the casting or constructing thereof separate or apart from the building to which they are attached or belong; neither do I claim any exclusive right to the introduction of iron beams in the ceilings or arches, or roofs of buildings, but merely employ them in aid of my said invention.

In witness whereof, &c.

On

On the ultimate Analysis of vegetable and animal Substances. By ANDREW URE, M. D. F. R. S.

With a Plate.

From the PHILOSOPHICAL TRANSACTIONS of the
ROYAL SOCIETY of LONDON.

THE improvements lately introduced into the analysis of vegetable and animal compounds, with the investigation of the equivalent ratios, in which their constituent elements, carbon, hydrogen, oxygen, and azote, are associated, have thrown an unexpected light into this formerly obscure province of chemical science. While the substitution by M. Gay Lussac, of black oxyd of copper for the chlorate of potash, has given peculiar facility and elegance to *animal* analysis; it may be doubted whether, in those cases, where the main object of inquiry is the proportion of carbon, it has not frequently led to fallacious results. As the quantity of this element is inferred from the volume of carbonic acid, evolved in the decomposition of the organic matters, such of their particles as happen not to be in immediate contact with the cupreous oxyd will remain unconverted into carbonic acid, and thus the proportion of carbon will come to be under-rated; an accident which cannot occur with chlorate of potash, since the carbonaceous matter is here plunged in an ignited atmosphere of oxygen. It is probably to this cause that we must refer the discrepant results in the analysis of pure sugar, between M. M. Gay Lussac, Thenard, and Berzelius, on the one hand, and Dr. Prout, on the other; the former gentlemen assigning about forty-three parts in the hundred of carbon, while the latter states the carbon at only forty*.

* Dr. Prout has informed me, since the above paper was written, that he re-triturated and re-ignited the contents of his tubes, in the analysis of sugar.

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The objects of the present paper are, first to indicate, and endeavour to remove several sources of fallacy attending the method with peroxyd of copper; and, next, to exhibit the results of its application to a considerable series of vegetable and animal compounds.

Peroxyd of copper, prepared by igniting the pure nitrate of this metal, is, like yellow oxyd of lead, and many other metallic oxyds, readily absorbent of a small portion of humidity from the air, the quantity of which depends, in some measure, on the length of time during which it has suffered ignition. If exposed to a red heat, merely till the vapours on nitric acid are expelled, 100 grains of the oxyd will absorb, in the ordinary state of the atmosphere, from one-tenth to two-tenths of a grain of moisture in the space of an hour or two; and about one half of the above quantity in a very few minutes. The French chemists, who have operated most with this agent, seem to be well aware of this circumstance, for they direct the peroxyd to be used immediately after ignition, and to be triturated with the organic matter in a hot mortar of agate or glass. Yet this precaution will not entirely prevent the fallacy arising from the hygrometric action; for I find that peroxyd thus treated does absorb, during the long trituration essential to the process, a certain quantity of moisture, which, if not taken into account, will produce serious errors in the analytical results. It is better therefore to leave the powdered peroxyd, intended for research, exposed for such time to the air, as to bring it to hygrometric repose; then to put it up in a phial, and by igniting one hundred grains of it in a proper glass tube sealed at one end, and loosely closed with a glass plug at the other, to determine the proportion of moisture which it contains. This, then, indicates the constant quantity to be deducted from the loss of weight which the
the

the peroxyd suffers in the course of the experiment. The mortar should be perfectly dry, but not warm.

Experimenters have been at great pains to bring the various organic objects of research to a state of thorough desiccation before mixing them with the peroxyd of copper; but this practice introduces a similar fallacy to that above described. We ought, therefore, after having made them as dry as possible by the joint agencies of heat, and an absorbent surface of sulphuric acid in vacuo, to expose them to the air till they also come into hygrometric repose, noting the quantity of moisture which they imbibe, that it may be afterwards allowed for. The plan which I adopt for the purpose of desiccation seems to answer very well. Having put the pulverulent animal or vegetable matter into short phials, furnished with ground glass stoppers, I place the open phials in a large quantity of sand heated to 212° F. in a porcelain capsula, and set this over a surface of sulphuric acid in an exhausted receiver. After an hour or more the receiver is removed, and the phials instantly stopped. The loss of weight shews the total moisture which each of them has parted with; while the subsequent increase of their weight, after leaving them unstopped for some time in the open air, indicates the amount of hygrometric absorption. This is consequently the quantity to be deducted in calculating experimental results.

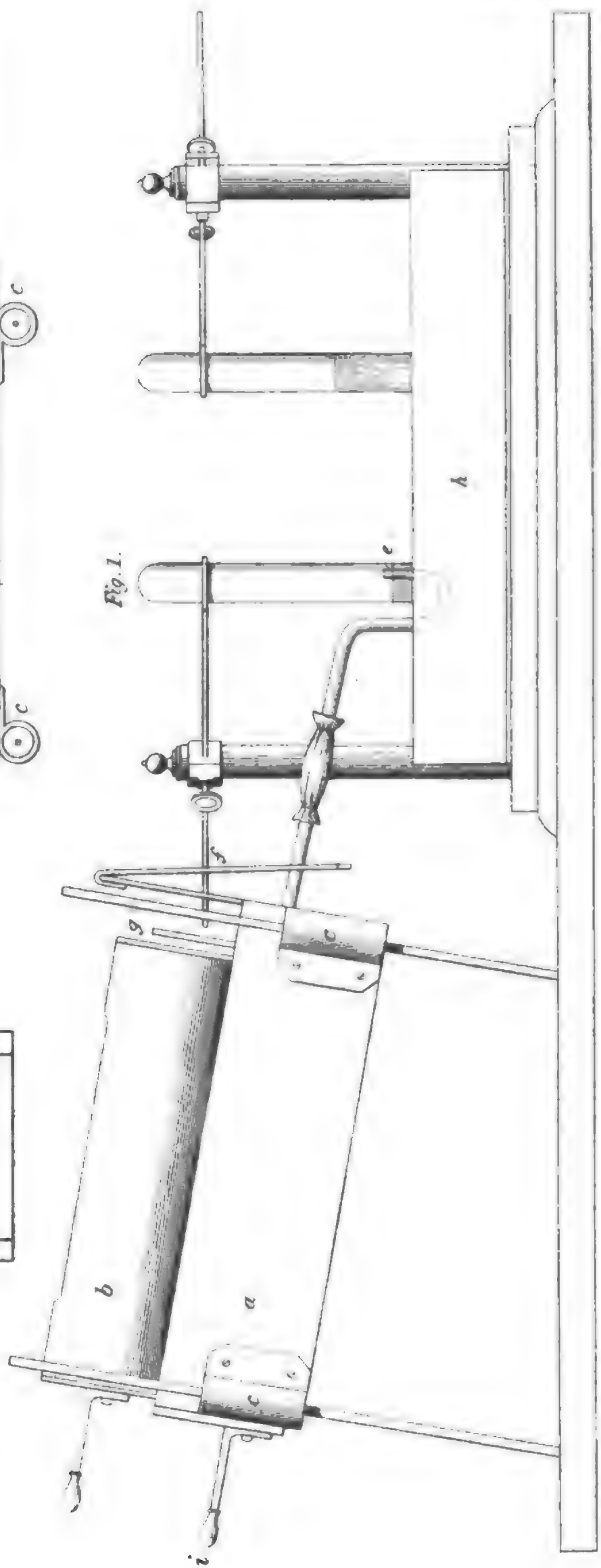
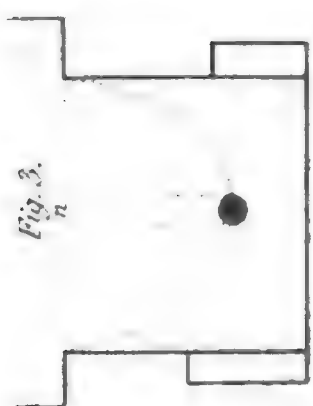
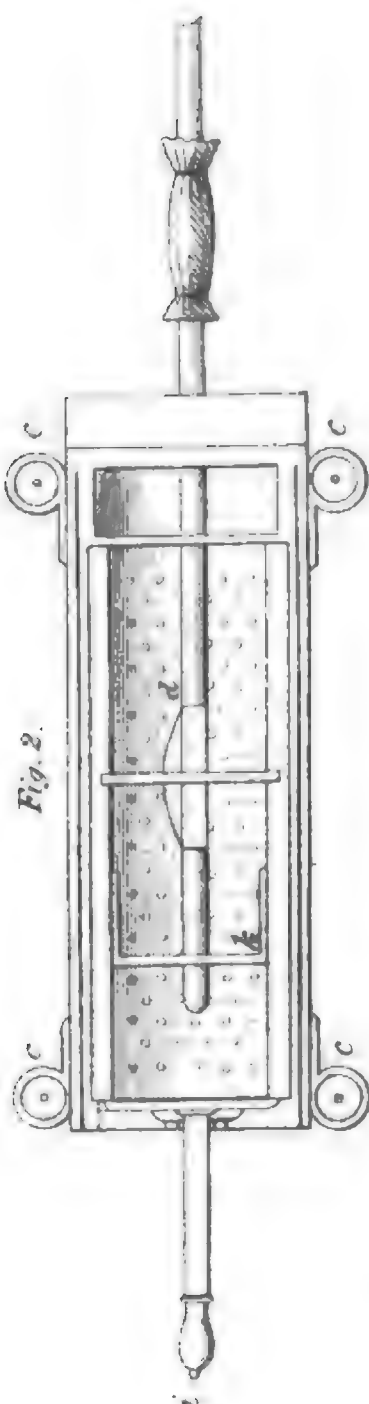
Many chemists, particularly in this country, have employed the heat of a spirit lamp, instead of that produced by the combustion of charcoal, for igniting the tube in which the mixed materials are placed. I have compared very carefully both methods of heating, and find that for many bodies, such as coal and rosin, which abound in carbon, the flame of the lamp is insufficient; while its application being confined at once to a small portion of the

the tube, that uniform ignition of the whole, desirable towards the close of the experiment, cannot be obtained. I was hence led to contrive a peculiar form of furnace, in which, with a handful of charcoal, reduced to bits about the size of small filberts, an experiment may be completed, without anxiety or trouble, in the space of half an hour. Since I have operated with this instrument, the results on the same body have been much more consistent than those previously obtained with the lamp; and it is so convenient, that I have sometimes finished eight experiments in a day.

Fig. 1 (Plate VIII.) represents the whole apparatus, as when in action. Fig. 2 is a horizontal section of the furnace, in which we perceive a semi-cylinder of thin sheet-iron, about eight inches long and three and a half wide, perforated with holes, and resting on the edge of a hollow prism of tin-plate, represented more distinctly in Fig. 3, where *n* shows a slit, through which the sealed end of the glass tube may be made to project, on occasion. *i* is the handle attached to the semi-cylinder, by which it may be slid backwards or forwards, and removed at the end of the process. *d* is a sheath of platinum foil, which serves, by aid of a wire laid across, to support the middle of the tube, when it is softened by ignition. At *g*, the plates which close the ends of the semi-cylinder and tin-plate prism rise up a few inches, to screen the pneumatic apparatus from the heat. A third occasional screen of tin-plate is hung on at *f*. All these are furnished with slits for the passage of the glass tube. This is made of crown-glass, and is generally about nine or ten inches long, and three-tenths of internal diameter. It is connected with the mercurial cistern by a narrow tube and caoutchouc collar. This tube has a syphon form, and rises about an inch within the graduated receiver at *e*. By this arrangement, should the collar

ACTS, DEEDS AND
TITLES FOUNDATIONS

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collar be not absolutely air-tight, the pressure of the column of mercury causes the atmospheric air to enter at the crevice, and bubbles of it will be seen rising up without the application of heat. At the end of the operation, the point of the tube is always left above the surface of the mercury, the quantity of organic matter employed being such as to produce from six to seven cubic inches of gaseous product, the volume of the graduated receiver being seven cubic inches.

As the tubes with which I operate have all the same capacity, *viz.* half a cubic inch; and as the bulk of materials is the same in all the experiments, one experiment on the analysis of sugar or resin, gives the volume of atmospheric air due to the apparatus, which volume is a constant quantity in the same circumstances of ignition. And since the whole apparatus is always allowed to cool to the atmospheric temperature, the volume of residual gas in the tubes comes to be exactly known, being equal, very nearly, to the primitive volume of atmospheric air left after the absorption of the carbonic acid in the sugar or resin experiment. Thus this quantity, hitherto ill appreciated or neglected in many experiments, though it is of very great consequence, may be accurately found. At *k*, Fig. 2, a little tin-plate screen is shown. It is perforated, for the passage of the tube, and may be slid along, and left at any part of the semi-cylindric cage, so as to preserve from the influence of the heat any requisite portion of the sealed end of the tube. At Fig. 4 is seen the shape of the little bulb, into which I introduce the proper weight of ether, alcohol, naphtha, or other volatile liquids, which are destined for analysis. After weighing it exactly, it is immediately slid down to the bottom of the tube, and covered with 150 or 200 grains of peroxyd of copper. The bulb has a capacity equal to
three

three grain measures of water, and its capillary point is sometimes closed with an inappreciably small quantity of bees'-wax, to prevent the exhalation of the liquid, till the peroxyd be ignited.

b is a cover to the furnace, with an oblong orifice at its top. It serves for a chimney, and may be applied or removed by means of its handle, according as we wish to increase or diminish the heat. *cc* are tin cases, inclosing corks, through which the iron wires are passed that support the whole furnace at any convenient height and angle of inclination.

The tightness of the apparatus at the end of the process is proved by the rising of the mercury, in the graduated receiver, by about one-tenth of an inch, as the tube becomes refrigerated.

My mode of operating with the peroxyd of copper is the following :

I triturate very carefully in a dry glass mortar, from 1 to $2\frac{1}{2}$ grains of the matter to be analyzed, with from 100 to 140 grains of the oxyd. I then transfer it, by means of a platinum-foil tray and small glass funnel, into the glass tube, clearing out the mortar with a metallic brush. Over that mixture I put 20 or 30 grains of the peroxyd itself, and next 50 or 60 grains of clean copper filings. The remaining part of the tube is loosely closed with ten or twelve grains of amianthus, by whose capillary attraction the moisture evolved in the experiment is rapidly withdrawn from the hot part of the tube, and the risk of its fracture thus completely obviated. The amianthus serves moreover as a plug, to prevent the projection of any minute particles of filings or of oxyd when the filings are not present. The tube is now weighed in a very delicate balance, and its weight is written down. A little cork, channelled at its side, is next
put

put into the tube, to prevent the chance of mercury being forced backwards into it, by any accidental cooling or condensation. The collar of caoutchouc is finally tied on, and the tube is placed, as is shewn in Fig. 2, but without the plate *k*, which is employed merely in the case of analyzing volatile liquids. A few fragments of ignited charcoal are now placed under the tube at the furnace next to the cistern, and the remaining space in the semi-cylinder is filled up with bits of cold charcoal. The top, *b*, may then be put in its place, when the operation will proceed spontaneously, the progressive advance of the ignition from one end to the other being proportioned to the expansion of glass, so that the tube very seldom cracks in the process. Indeed I have often used the same tube for a dozen experiments, in the course of which it became converted into *vitrite*, or Reaumur's porcelain.

Since the evolved gas is saturated with moisture, I reduce it to the volume of dry gas, by help of the following table, computed by the well-known formula from my table of the elastic force of steam, which the Royal Society did me the honour to publish in their Transactions for the year 1818:

Tem- perature.	Multiplier.	Tem- perature.	Multiplier.	Tem- perature.	Multiplier.
53°F.	0.9870	61°F.	98.20	70°F.	0.9758
54	0.9864	62	98.13	71	0.9751
55	0.9858	63	98.06	72	0.9743
56	0.9852	64	97.99	73	0.9735
57	0.9846.	65	97.93		
58	0.9839	66	97.86		
59	0.9833	67	97.79		
60	0.9827	68	97.72		
		69	97.65		

In certain cases, where the quantity of hydrogen is small, or where, as in the example of indigo, its presence has been denied, I employ pulverulent proto-chloride of mercury (calomel) instead of peroxyd of copper. The organic compound being intimately mixed with that powder, and gently heated, the muriatic acid gas obtained, demonstrates the presence, though half of its volume will not give the total quantity, of hydrogen; for a proportion of this elementary body continues associated with oxygen in the state of water. Dry oxalate of lead, treated in this way, yields not the slightest trace of muriatic acid, for on passing the disengaged gas through a dilute solution of nitrate of silver, no precipitation or even cloud of chloride is produced. But five grains of indigo, prepared from the de-oxydized solution of the dyer's vat, and freed from its lime and resin by the successive application of dilute muriatic acid and alcohol, gave five cubic inches of muriatic acid gas when heated along with 150 grains of calomel. Here we have a quantity of gas equivalent to two and a half cubic inches of hydrogen.

By means of peroxyd of copper, however, nearly four times the above quantity of hydrogen may be obtained from the same weight of indigo.

I shall now give in detail, one example of the mode of computing the relation of the constituents from the experimental results, and shall then state the other analyses in a tabular form, subjoining a few remarks on the habits of some peculiar bodies.

1.4 grains of sulphuric ether, specific gravity 0.70, being slowly passed in vapour from the glass bulb through 200 grains of ignited peroxyd of copper, yielded 6.8 cubic inches of carbonic acid gas at 66° F. which are equivalent

valent to 6.57128 of dry gas at 60°. This number being multiplied by 0.127 = the carbon in one cubic inch of the gas, the product 0.8345256, is the carbon in 1.4 grains of ether; and $0.8345256 \times \frac{8}{3} = 2.2254$ = the oxygen equivalent to the carbonic acid. The tube was found to have lost 4.78 grains in weight, 0.1 of which was due to the hygrometric moisture in the oxyd, and 1.4 to the ether. The remainder, 3.28, is the quantity of oxygen abstracted from the oxyd by the combustible elements of the ether. But of these 3.28 grains, 2.2254 went to the formation of the carbonic acid, leaving 1.0546 of oxygen, equivalent to 0.1318 of hydrogen. Hence, 1.4 ether by this experiment, which is taken as the most satisfactory of a great number, seem to consist of

Carbon	0.8345
Hydrogen	0.1318
Water	0.4337
	1.4000

And in 1 grain we shall have

Carbon	0.5960	3 atoms	2.25	60.00
Hydrogen	0.1330	4 atoms	0.50	13.33
Oxygen	0.2710	1 atom	1.00	26.66
	1.0000		3.75	100.0

$$\begin{array}{rcl}
 \text{Or, 3 volumes of olefant gas} & = & 3 \times 0.9722 = 2.9166 \\
 2 \quad \cdot \quad \cdot \quad \text{vapour of water} & & \cdot 2 \times 0.625 = 1.25 \\
 & & \hline
 & & 4.1666
 \end{array}$$

which suffering a condensation equal to the whole vapour of water, will give an ethereous vapor, whose specific gravity is 2.5.

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The proportion of the constituents of sulphuric ether, deduced by M. Gay Lussac from the experiments of M. Th. de Saussure, are 2 volumes olefiant gas + 1 volume vapour of water, which 3 volumes are condensed into 1 of vapour of ether, having a specific gravity = 2.58. The ether which I used had been first distilled off dry carbonate of potash, and then digested on dry muriate of lime, from which it was simply decanted, according to the injunction of M. de Saussure. Whether my ether contained more aqueous matter than that employed by the Genevese philosopher, or whether the difference of result is to be ascribed to the difference in the mode of analysis, must be decided by future researches.

By analogous modes of reduction, the following results were deduced from my experiments. I ought here to state, that in many cases the materials, after being ignited in the tube, and then cooled, were again triturated in the mortar, and subjected to a second ignition. Thus, none of the carbon could escape conversion into carbonic acid. I was seldom content with one experiment on a body; frequently six or eight were made.

TABLE

TABLE of organic Analyses.

	Substance.	Carbon.	Hydrogen.	Oxygen.	Azote?	Water.	Excess.
1	Sugar	43.38	6.29	50.33		56.62	Oxygen.
2	Sugar of diabetes	39.52	5.57	54.91		51.13	10.35
3	Starch	38.55	6.13	55.32		55.16	6. 3
4	Gum Arabic.....	35.13	6.08	55.79	3?	54.72	7.15
5	Resin	73.60	12.90	13.50		15.20	Hydrogen.
6	Copal	79.87	9.00	11.10		12. 5	11.20
7	Shell lac	64.67	8.22	27.11		30.51	7. 6
8	Resin of guaia....	67.88	7.05	25.07		82.	4.82
9	Amber	70.68	11.62	17.77		20. 0	3.93
10	Yellow wax	80.69	11.37	7.94		8.93	9.40
11	Caoutchouc	90.00	9.11	0.88		.99	10.39
12	Splent coal	70.90	4.30	24.80		27.90	9.00
13	Cannel coal	72.22	3.93	21.05	2. 8	23.68	1.20
14	Indigo	71.37	4.38	14.25	10.	16. 0	1.30
15	Camphor	77.38	11.14	11.48		12.91	2.52
16	Naphthaline	91. 6	7. 7	0.70?		0.79?	9.71
17	Spermaceti oil....	78.91	10.97	10.12		11.34	9.71
18	Common oil of tur- pentine	82.51	9.62	7.87		8.85	8. 4
19	Purified oil of tur- pentine	84. 9	11. 5	3. 6		4. 0	11. 1
20	Naphtha	83.04	12.31	4.65		5.23	11.73
21	Asiatic castor oil..	74.00	10.29	15.71		17.67	8.33
22	Alcohol, sp. gr. 0.812	47.85	12.24	39.91		44. 9	7.25
23	Ether, specific gra- vity 0.70	59.60	13. 3	27. 1		30. 5	9. 9
24	Bleached silk	50.69	3.94	34.04	11.33	35.43	Oxygen.
25	Cotton	42.11	5.06	52.83		45.56	2.55
26	Flax by Lee's pro- cess	42.81	5. 5	51. 7		49. 5	12.38
27	Common flax	40.74	5.57	52.79	0. 9	50.16	7. 7
28	Wool	53. 7	2.80	31. 2	12. 3	25. 7	8. 2
29	Cochineal.....	50.75	5.81	36.53	6.91	39. 6	8. 3
30	Cantharides.....	48.64	5.99	36.29	9.08	40.83	Hydrogen.
31	Urea.....	18.57	5.93	43.68	31.82	49.14	14. 1
32	Benzoic acid	66.74	4.94	28.32		31.86	14.53
33	Citric acid	33.00	4.63	62.37		41.67	0.47
34	Tartaric acid	31.42	2.76	65.82		24.84	1. 4
35	Oxalic acid	19.13	4.76	76.20		42.87	Oxygen.
36	Ferropussic acid	36.82	27.89 of iron		35.39		25.33
							43.74
							38.09

Remarks

Remarks on the preceding Analyses.

1. *Sugar.* The sugar which I employed had been purified by Mr. Howard's steam process, and was so well stove-dried, that it lost no appreciable portion of its weight when inclosed along with sulphuric acid in *vacuo*. The diabetic sugar has a manifest excess of oxygen, which I believe to be the case with all weak sugars, as they are called by the sugar refiners. I consider this excess of oxygen as the chief cause which counteracts crystallization, and therefore the great obstacle to the manufacturer. The smallest proportion of carbon, which I have ever found in any cane-sugar, was upwards of 41 *per cent.* The experiments on starch and gum were among the earliest which I made; and the results differ so much from those given by other experimenters, that I shall repeat the analyses at the earliest opportunity. The constituents of the above three bodies, referred to the prime equivalent scale, will be approximately as follows:

Sugar.			Starch.			Gum.		
Carbon... 5 atoms	3.75	45.4	5 atoms	3.75	40.5	4 atoms	3.0	35.25
Oxygen... 4 —	4.00	48.5	5 —	5.00	54.0	5 —	5.0	58.90
Hydrogen 4 —	0.50	6.1	4 —	0.50	5.5	4 —	0.5	5.85
	8.25	100.0		9.25	100.0		8.5	100.00

I conceive the purest and stongest sugar to be constituted as here represented.

All the elementary principles of organic nature may be considered as deriving the peculiar delicacy of their chemical equilibrium, and the consequent facility with which
it

it may be subverted and new modelled, to the multitude of atoms grouped together in a compound. On this view, none of them should be expected to consist of a single atom of each component. The allurements of theoretic simplicity has led some ingenious philosophers to represent sugar by 1 atom of carbon, 1 atom of oxygen, and 1 atom of hydrogen; or of 40 carbon, $53\frac{1}{2}$ oxygen, and $6\frac{2}{3}$ hydrogen, in 100 parts. But I am satisfied that all sound specimens of sugar will yield considerably more carbon than 40 *per cent*.

Starch is liable to a similar deterioration with sugar; that is, some species of it make a much firmer coagulum with hot water than others; a difference probably due to the proportion of oxygen. The starch here employed was that of commerce, and was not chemically desiccated: hence the redundancy of water beyond the equivalent proportion. A little hygrometric moisture was present also in the gum, as it was not artificially dried. A note of interrogation is placed after azote. That doubt will, I trust, be solved, when I complete my analyses of grains, roots, and leaves, with the view of tracing the origin of azote in the bodies of graminivorous animals.

TO BE CONTINUED.

Description

Description of an improved Mode of opening and shutting the Windows of Churches and other public Buildings, for the Purpose of Ventilation. By Mr. W. BAILEY, 272, High Holborn.

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the ENCOURAGEMENT of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal was given to Mr. BAILEY for this Communication.

THE following communication to the Society of Arts, on an improvement in the mode of opening church-windows, and other fixed sashes, is generally applicable to halls, courts of justice, assembly-rooms, and all places that, from their crowded state, may require extensive ventilation.

To exemplify the operation more fully than could be done by mere description, I have sent a glazed model of a window, formed with solid wrought-iron sash-bars; which bars I have extensively applied in the erection of curvilinear hot-houses, green-houses, and conservatories, their strength and lightness rendering them well adapted to the construction of every description of lights and sashes.

It has long been a subject of complaint, that our churches and public edifices are kept too close and confined for the health and comfort of the large congregations that assemble in them. Various contrivances attached to the windows, for the emission of the foul air, and the admission of fresh air, so necessary for the purpose of ventilation, have been adopted, and more particularly in our churches, but none of them have been applied where their action would be most efficacious; which

which is at the upper portion of the window, and few of them without producing effects equally inconvenient as those they are intended to remedy.

The old mode was, by means of casements, hung upon hinges, and fastening with a latch; these to be within reach were necessarily placed very low, and consequently when opened produced only a trifling ventilation, while the admitted air coming immediately on the persons near them, was extremely inconvenient, and prevented the casements being often opened.

A later and improved mode has been to hang the casements to swing on centre pivots, and to place them about the middle of the windows, so that, when open, one part of the casement is on the inside of the church, and the other part on the outside. This mode is liable to the objection of the air falling on the heads of the persons assembled, and its affording no defence against the admission of a shower of rain. These casements also require pullies and lines, hanging in the middle of the window, to open and shut them, operations generally accompanied with considerable noise and consequent disturbance.

Another mode, that has been lately very much adopted, is, to cut out of the windows a space to receive the half of a glazed hopper, which is attached to the window projecting inwards, having a flap on the top, lying horizontally, and opening upwards. These hoppers are extremely unsightly in themselves, but are rendered still more so by the dust which falls and lodges on them, and they are subject to the further inconvenience of the dust being blown into the church when the flap is raised for the admission of air.

I flatter myself, on the inspection of the model, which I have the honour of submitting to the Society, it will
be

be found that the above-stated inconveniences are obviated, and a ready mode of action on the upper part of the window is obtained, by means of simple and effective machinery, while the symmetry of the window is preserved. It may be proper to observe, that in case of the upper part of the window being square, and not having any mullions, it will be found necessary (to prevent the entrance of the air at the sides of the casement when it opens) to have a frame, with two angular-glazed sides attached to the windows; and these sides must have a small return rebate for the casement to fall against when it is fully opened, which will effectually prevent any inconvenience arising from the form of the window.

P.S. I have inclosed a certificate from the minister and churchwardens of the parish of St. Anne's, Aldersgate, who have had these windows in use since 1820.

CERTIFICATE.

Vestry-room of St. Anne's, April 24, 1822.

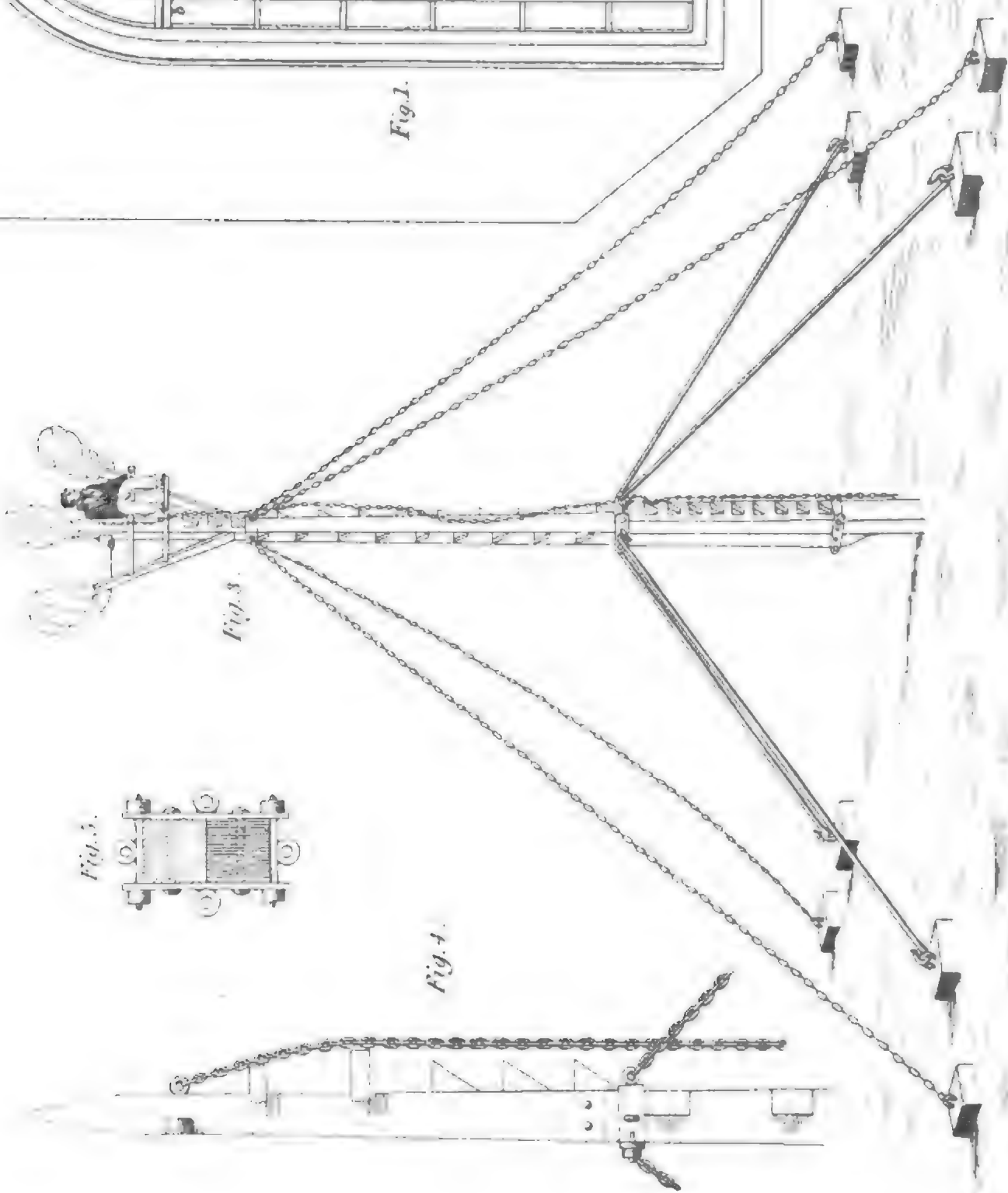
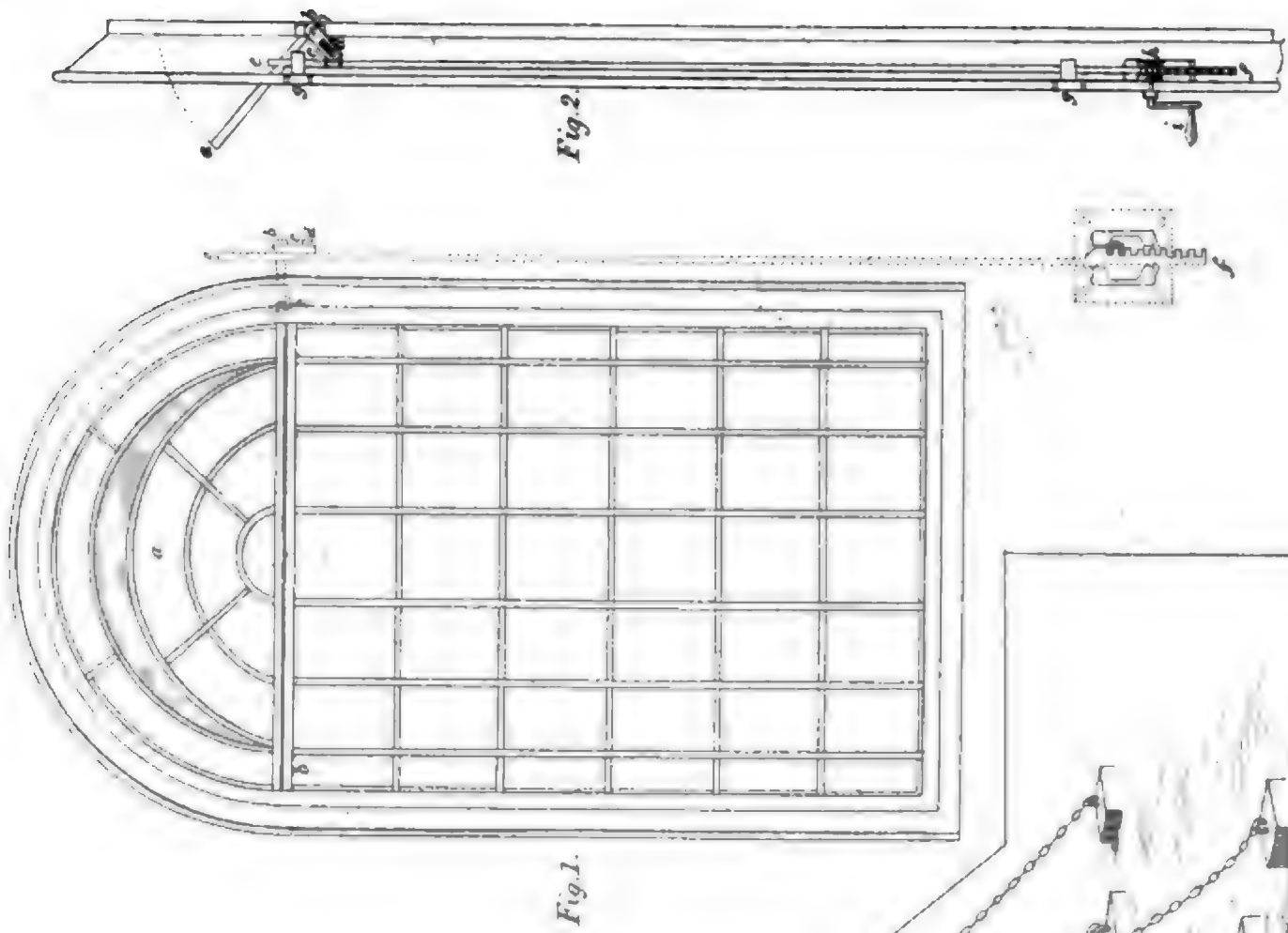
We beg to certify, that Messrs. Baileys, in the summer of 1820, fixed, in the church of the united parishes of St. Anne's, St. Agnes, and St. John Zachary, four of their iron sash bar-windows, with opening casements, which have been found to answer the purpose extremely well; and we think are so much superior to the windows commonly used in churches, and the usual modes of admitting air into them, that if they were generally known they would be universally adopted.

JAMES HUTCHINS, A. M. Minister.

W. MATTHEWS,
T. MAYFIELD, } Churchwardens.

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REFERENCES TO THE ENGRAVING.

Fig. 1, (Plate IX.) a front inside view of a window, with the apparatus attached.

Fig. 2 is a lateral view of the apparatus.

a is the flap of the window open, forming an angle of about 45 degrees with the plane of the sash. *b b*, a bar, to which the base of the flap is fixed, and on which it turns. *c*, a lever, having one end fastened to the extremity of the bar *b*, and furnished at the other end with an eye, which receives the pin or stud *d*. This stud is fixed on the vertical rod *e*, which terminates below in a rack *f*, and is secured in an upright position, by the loops or guides *g g*, through which it passes. *h* is a lanthorn-pinion of two teeth, which, when turned round by means of the winch *i*, take into the notches of the rack, and consequently draw down the rod *e*, or raise it, according to the direction in which the winch is turned.

In the first case, the stud *d* draws the lever down, and consequently opens the window, which is the position represented in the engraving; in the latter case the stud is raised, and with it the lever, which closes the window.

The teeth of the lanthorn-pinion are adjusted in such a manner, that when the window is closed the two teeth of the pinion are in a vertical position: this is necessary, because a two-leaved pinion cannot remain at the quarter turn.

A front view of the box, in which the rack and pinion are contained, is shewn in Fig. 1. The square end of the axis of the pinion projects beyond the box, for the purpose of conveniently receiving the winch, and may itself be inclosed in a barrel, to prevent it from being bent by any accident.

Description of a Life Beacon. By Mr. GEORGE HOLDITCH, Keeper of the Buoys and Beacons of the Port of Lynn, Norfolk.

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the ENCOURAGEMENT of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal and Ten Guineas were presented to Mr. HOLDITCH for this Communication.

ALTHOUGH the establishment of life beacons on dangerous sands at sea has been long practised, yet their construction has hitherto been far from perfect, and the expense of erecting them has generally been so considerable as to restrict them to a very few situations. The beacon which is the subject of the present communication, will, I believe, be found to be free, in a great degree, from both these objections: I have, therefore, forwarded a model of it to the Society for the Encouragement of Arts, Manufactures, and Commerce, for their inspection and judgment, in hopes that it may meet with their approbation; and obtain, through the medium of their Transactions, that publicity which may lead to its general adoption. I flatter myself that the lives of many valuable seamen engaged in the laborious and hazardous navigation of the coasts of this kingdom, may thus be saved to their families, and to the community at large.

In the year 1812, the channel leading to and from the port of Lynn, altered about five miles to the westward, which brought the ships, in their course up and down this navigation, near a sand called the Long-sand, which is very steep, and about six miles from the nearest shore.

This

This caused a general wish from the ship-masters of the port to have a beacon placed upon this sand if possible. A petition was accordingly drawn up and presented to the corporation of Lynn, requesting them to bear the expense of the same, which they readily granted.

I immediately set about the work. In the first place, a ten-inch square main piece was driven into the sand twelve feet, with a topmast thirty-six feet above the level of the sand, and four posts were driven seven feet into the sand for brace-posts; but as soon as there was a heavy sea from the eastward, and a gale of wind, the motion of the braces shook the posts entirely out of the sand. I then secured the braces by heavy stones let into the sand, which held firm until the heavy gale of wind, March the 2d, 1820, when the whole was washed down.

In July, 1820, I erected another beacon, the model of which accompanies this statement, and which, from its having remained uninjured to the present time, shows that the imperfections in the construction of the first beacon have been successfully avoided.

The main-piece is a tree of English oak of the best quality, twenty-seven feet long and twelve inches square, shod with iron for four feet, and for five feet above filled close with scuppers (short large-headed nails). It was bound round at its upper-end with three strong iron hoops, to prevent it from splitting; and, being thus prepared, was driven about sixteen feet into the sand, by means of a crane and beetle of thirteen hundred weight.

The topmast is made of a good red-wood spar, thirty-seven feet long, and tapering off from twelve inches, its diameter at its base, to six and a half inches its diameter at the top. It is secured to the main-piece by two stout iron clasps and screw-bolts; and to the upper of these clasps are fixed four rings or eyes, to serve as the attachment

ment of as many bars of iron, one and a half inch square and twenty-eight feet long. The lower end of each bar is bolted to a flat block of stone weighing six hundred weight. The stone is buried in the sand, and in a month or two gets so firmly embedded by the tremulous motion impressed by the sea on the shaft, that it would form a secure mooring for a vessel of one hundred tons.

A similar iron clasp, with eye-bolts, is fixed round the topmast, about eight feet from its summit, and to this are attached four chains, each having a block of stone of four hundred weight at the other end. These stones, like the others, soon get buried in the sand, so as to keep the chains in a state of tension; and consequently give additional support to the beacon. Just above the upper clasp are three short spars, forming an inverted triangle for the purpose of supporting more firmly the seats which are fixed to the topmast, each piece being terminated by a head of light basket-work, in order to render the beacon more conspicuous. From the seats down to the bottom of the shaft, are cleats, by which, with the assistance of a chain for a man-rope, a sailor or other person may easily ascend to the top of the beacon.

The beacon is erected on the highest part of the Long-sand, so that, even in thick weather, persons who may be upon the sand will naturally, as the water rises, be directed to it. Nor is this matter of mere speculation; for three weeks after it was erected, two men belonging to his Majesty's surveying brig, Protector, lost their way in a fog on this very sand, and were preserved by retreating before the advancing tide till they arrived at the beacon.

The distance from which it is visible in clear weather without a glass is about seven miles; it being seen from Boston and Lynn Knock buoys to the N. E.; from
Huns-

Hunstanton cliff to the S.; and from buoy No. 2 in Lynn Well to the W.

The utility of such a beacon on islands of sand which are covered at high-water will, I trust, induce other corporations to erect them in suitable places within their jurisdiction.

The average expense of such a beacon on a sand like ours, seven feet above low-water mark, would be about 80*l*.

REFERENCE TO THE ENGRAVING.

Fig. 3 (Plate IX.) represents the life beacon, consisting of the main-piece, secured by two clasps to the topmast, with the iron bars and large blocks of stone, and the iron chains and smaller blocks by which the beacon is prevented from being forced out of the sand. It also shows the cleats, the man-rope, the seats on the inverted triangle, and the basket-work heads by which it is terminated—the whole being on a scale of one-twelfth of an inch to a foot.

Fig. 4 is a lateral elevation of the upper part of the topmast, shewing the seats, the man-rope, and the iron clasp to which the four chains are fixed.

Fig. 5 is a plan of the clasp to which the four iron bars are attached.

Figs. 4 and 5 are on a scale of a quarter of an inch to a foot.

CERTIFICATES.

Lynn Regis, October, 1821.

The buoy and beaçoner of this port, Mr. George Hol-ditch, having requested my opinion of a life beacon erected by him on a dangerous sand called the Long-sand, at the entrance of this channel from the sea, I beg leave

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to state, that I think it is calculated fully to answer the purpose for which it was intended. It is an invention of his own, and I have no doubt, if the great benefits likely to result from it to mariners were generally known, it would be applied to similar places, as far as practicable.

THOMAS ALLEN, *Mayor.*

This is to certify, that I have cruized up and down Lynn Well, and have found the beacop on the Long-sand, erected by Mr. George Holditch, to be a most useful mark for the above place; and in consequence of shipwreck, it would be found particularly serviceable in saving the lives of the people.

JOHN LEAFORD, *Commander of the Erin.*

On giving Magnetic Power to Iron or Steel, and on completely freeing those Substances from Magnetism, by hammering them while in certain Positions.

Abridged from the EDINBURGH PHILOSOPHICAL JOURNAL.

DR. GILBERT, two hundred years ago, discovered that iron made red-hot, and then drawn out by hammering while placed in the magnetic meridian, became magnetical. Mr. Scoresby has ascertained that a horizontal position in the magnetic meridian was by no means the best position for the developement of magnetism by percussion; but that the position of the dipping-needle given to bars of iron, when hammered, produced the highest effect. A single blow with a hammer on a bar of soft iron, held vertically, was found to be capable of giving it a strong magnetic action on the compass, the upper end becoming a South pole, and the lower end a North

North pole: on inverting the bar, another blow was found sufficient to change the polarity formerly given to it. But one of the most important effects of percussion observed by Mr. Scoresby was found to be this, that a blow struck upon any part of a bar of iron, while held in the plane of the magnetic equator (which is horizontal E. and W., or with the North end elevated about 19 degrees above the horizontal line in this country), has an invariable tendency to *destroy* its magnetic action, which it generally does so effectually as to prevent its exerting any influence over a compass, when presented to it in the same plane of the magnetic equator.

Previously no other method was known of freeing iron or steel completely from magnetism, but that of heating it red-hot, and allowing it to cool in a horizontal position East and West. This process, however, besides spoiling the surface of the metal is troublesome, and seldom completely effectual in its application. But the same object is accomplished in a moment, and with infinitely better effect by Mr. Scoresby's process, merely by a slight blow or two with a hammer, while the iron or steel is held in the magnetic plane, and is equally applicable to very large and heavy bars. Grinding, filing, polishing, drilling, turning, twisting, bending, &c. were all found to elicit magnetic attraction, when performed in a vertical position, or any position out of the magnetic plane; but the same processes were destructive of polarity, when performed on a bar or plate of untempered metal, while held in the plane of the magnetic equator. Hence the magnetism of steel chronometer balances would no doubt be prevented, and even destroyed if they had previously obtained it, by turning them into form, and polishing them in the plane of the magnetic equator.

Mr. Scoresby found that soft steel received the greatest degree

degree of magnetic energy by percussion. In soft iron the magnetism was strong, but evanescent; in hard steel and cast-iron, weak, but permanent. Magnetism in steel being more readily developed by the contact of magnetizable substances, and particularly if these substances be already magnetic, it was found that the magnetizing effects of percussion were greatly increased, by hammering the steel bar with its lower end resting on the upper end of a large rod of iron or soft steel, both the masses being held in a vertical position, and especially if the rod were first rendered magnetic by hammering. Mr. Scoresby found that small or slender bars acquired a much greater lifting power, in proportion to their weight, than large bars. There was an increase of attraction in bars of the same diameters, when the lengths were increased. The quantity of magnetism developed by this process was increased by a frequent repetition of the experiment with the same bars.

Mr. Scoresby being desirous of applying the process to the construction of powerful artificial magnets, prepared six bars of soft steel, and bars properly tempered, suitable for a large compound magnet. The soft steel bars were nearly eight inches long, half an inch broad, and a sixth of an inch thick: The bars for the compound magnet, seven in number, which were of the horse-shoe form, were each two feet long before they were curved, and eleven inches from the crown to the end, when finished, one inch broad and three-eighths thick. These bars were combined by three pins passing through the whole and screwing to the last; and any number of them could be united into one magnet, by means of a spare set of pins screwed throughout their length, and furnished with nuts. In addition to these bars, &c. he provided separate feeders or conductors of soft iron, suitable

able for connecting the poles of each of the bars of the compound magnet, and also another conductor fitted to the whole when combined. To communicate the magnetic virtue, a rod of soft steel was hammered for a minute or two, while held vertically upon a large bar of soft iron in the same position; this gave considerable magnetism to the steel rod. Every one of the six bars of soft steel was then hammered on the top of this steel rod, until the accession of lifting power ceased. Then fixing two of them on a board, with their different poles opposite, and formed by a feeder at each end into a parallelogram, these were rubbed after the manner of Canton, by means of the other four bars, and thus their magnetism was greatly augmented. The other four bars were operated upon in pairs, in a similar way, those already strengthened being used for strengthening the others, and each pair being successively changed, until all the bars were found to be magnetized to saturation. A pair of them now possessed a lifting power of two pounds and a half.

The next step was to touch the bars intended for the compound magnet, by means of these six bars now magnetised. For this purpose the six bars were combined into two magnets, by tying three of them together with similar poles in contact; these two were then placed with opposite poles in connection, and tied together at one end, but separated about the third of an inch at the other, so as to form one compound magnet, and a conductor was kept constantly applied to the open end of it when not in use, to preserve the power from being lost. One of the bars of the horse-shoe magnet, with a conductor placed across the poles, was now placed on a board, in a groove cut out so as to hold it fast under the operation. The straight bar magnet was then placed erect on

the middle of it, with the separated poles downward, and rubbed against the horse-shoe bar from the middle to one of its poles, until the North pole of the one was in connection with the pole intended to become South of the other; from thence it was rubbed back again, with the South pole of the magnet in advance, as far as the other extremity, or that intended for the North pole of the horse-shoe bar. Two or three strokes of this kind being made from end to end of the bar, on each side of it, the South and North poles of the magnet being always directed to the South and North poles of the bar respectively, the magnet was slipped sideways off when at the pole of the bar, and the bar was found to have acquired such a magnetic power as to enable it to sustain a weight of several ounces hung from the conductor. Each of the bars of the horse-shoe magnet was treated this way in succession, and then the first five bars of the magnet being combined by the screws, were employed in the same way as the soft steel magnet had been used, for increasing the power of the sixth and seventh bars, by which they were rendered capable of carrying above two pounds weight each. These were then substituted in the combined magnet, for the fourth and fifth bars, while the latter underwent the touch of the other five in combination, and in their turn, the second and third, and then the seventh and first, were subjected to similar treatment. After these operations, which occupied 48 minutes, the compound magnet, with all the seven bars in connection, lifted ten pounds; after a second series of the same kind of manipulations, five of the bars in combination carried fifteen pounds; and after a third series eighteen pounds; but as, on trying a fifth series, little argumentation took place, the process was discontinued. The whole of the operations, from beginning to end,

end, occupied above four hours; but as each bar was generally rubbed with twelve strokes on each side, instead of one or two, which were afterwards found to be sufficient, and in other parts of the process a great deal of time and labour were spent which turned to no account; no doubt but the whole might have been completed, beginning without the smallest perceptible magnetism, and ending with a lifting power of twenty or thirty pounds, in the space of two hours or less. As steel does not receive, immediately on being touched, the full degree of magnetic energy of which it is susceptible, a conductor was applied to the magnet now formed, and it was laid aside, with the view of augmenting its power on a subsequent occasion.

Upon the Effects of very high Temperature on some Species of Plants. By THOMAS ANDREW KNIGHT, Esq.
F. R. S. &c.

From the TRANSACTIONS of the LONDON
HORTICULTURAL SOCIETY.

HAVING constructed a forcing-house, for the purpose of attempting the culture of the mango and a few other species of tropical fruits, I have endeavoured to ascertain with accuracy the advantages and disadvantages of employing *very high temperature*, during the day, in bright weather, and of comparatively low temperature, during the night, and in cloudy weather; and I communicate the following account of my experiments, considering the results to have been generally very favourable, and, where unsuccessful, not wholly uninteresting.

A fire of sufficient power only to preserve in the house a temperature of about 70° during summer, was employed; but no air was ever given, nor its escape facilitated, till the
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thermometer, perfectly shaded, indicated a temperature of 95°; and then only two of the upper lights, one at each end, were let down about four inches. The heat of the house was consequently sometimes raised to 110° during the middle of warm and bright days, and it generally varied in such days from 90 to 105°, declining during the evening to about 80°, and to 70° in the night.

Late in the evening of every bright and hot day, the plants were copiously sprinkled with water, nearly of the temperature of the external air; and the following were the effects produced upon the different species:

The Melon. — Plants of this species were trained upon a trellis near the glass, which was of the best quality, and these exhibited a greater degree of health and luxuriance than I had ever before seen, but not a single flower ever unfolded; a great profusion of minute blossoms, nevertheless, appeared in succession at the points of the shoots, all of which perished abortively. I was much disappointed at the result of this experiment, from which I confidently expected to obtain fruit of the greatest excellence.

The Water Melon. — A plant of this species, treated in the same manner as the melon plants above mentioned, grew with equal health and luxuriance, and afforded a most abundant blossom; but all its flowers were male. This result did not in any degree surprise me, for I had many years previously succeeded, by long-continued very low temperature, in making cucumber plants produce female flowers only; and I entertain but little doubt that the same fruit-stalks might be made, in this and the preceding species, to support either male or female flowers, in obedience to external causes.

The Guernsey Lily. — I transferred plants of this species from the open air to the hot-house in the summer, with

with the hope of obtaining seeds, in which I was wholly disappointed. The flowers expanded very beautifully, but their pollen never shedded. The plants have, nevertheless, subsequently grown with more than ordinary vigour; and I entertain scarcely any doubt that the same roots, which afforded flowers in the present season, will blossom strongly in the next. It appears, therefore, from this and the two preceding experiments, that the same degree of temperature which may promote the growth and exuberant health of the plant, may at the same time render it wholly unproductive of fruit or offspring.

The Fig-tree. — Several varieties of this species were subjected to experiment, but the trees, although planted in pots, grew with so much luxuriance, and afforded me so little prospect of fruit, that I removed all except those of the large white variety, from the house. The white fig-tree succeeded perfectly; first ripening its spring-figs (those which usually ripen in the open air in this country), and afterwards its summer-figs. The trees then produced new leaves and branches; and the fruit, which would have appeared in the next spring, ripened in high perfection in September. Subsequently, also, a few of those which, in the ordinary course of the growth of the tree, would have appeared as the summer-crop of next year, have ripened; and these, though far inferior to those of the preceding crops, have not been without merit.

The Nectarine. — A seed of this species of fruit was planted in a hot-bed in January last, and it vegetated in the succeeding month. It was subsequently removed to the hot-house, in which it continued to grow through the summer, without being in the smallest degree drawn by the high temperature in which it was placed; its wood, on the contrary, is remarkably short-jointed, and
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is covered with blossom-buds, from which I think it will be practicable to obtain ripe fruit, within sixteen months of the period at which the plant first sprang from the ground.

The Orange and Lemon.—A very high temperature appeared peculiarly favourable to plants of these species, or, I believe, more properly of this species; for I consider both, with the citron and shaddock, to be varieties only of the lime. A plant which sprang from seed in March, had in the end of August attained the height of more than four feet, with proportionate strength; when wanting the place it occupied for another purpose, it was removed from the house. I obtained in April a plant of the China-orange, with one very small fruit upon it, which has ripened in much apparent perfection, and the tree exhibits every appearance of the most exuberant health.

The Mango (Mangifera Indica).—This species of fruit-tree appears to possess great peculiarity of constitution; for, although a native of a very hot and bright climate, and capable of bearing, with apparent benefit, the hot drying winds of Bengal, it vegetates freely, and retains its health in comparatively low temperature, and under a cloudy atmosphere. The plants I possess sprang from seeds in October 1818, and their leaves acquired, during winter, their proper dark green colour, and remained in perfect health till spring; although not possessing at that period a hot-house, I was very ill prepared to preserve them. In March they began to shoot a second time, without having been, I believe, at any period subjected to a higher temperature than 60°, and some of them are now shooting strongly, although the temperature of my house, during the last five weeks, except once or twice
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in very bright days, has rarely been so high as 60°. The mode of growth of this plant appears also to be very singular; it extends a few inches, and then closes its terminal buds, as if its growth for the season were ended. One of my plants has done so nine times within the last thirteen months, without having acquired a greater height than two feet seven inches. I am much inclined to believe that the mango might be raised in great abundance, and considerable perfection, in the stove in this country, for it is a fruit which acquires maturity within a short period. It blossoms in Bengal in January, and ripens in the end of May; and Mr. Turner, in his journey to Tibet, states that he found the mango growing in latitude 27° 50' in Boutan, in the same orchard with the apple-tree; the apples ripening in July, and the mangos in September. And another Eastern traveller of credit (I think it is Mr. Barrow), mentions an instance in which a frost, sufficiently severe to have injured the crops of barley, had proved fatal to the blossoms (only) of the mango trees.

The Alligator or Avocado Pear (Laurus Persea).—The plants of this species have grown with rather troublesome luxuriance in my house, though they have been generally confined to small pots; one plant, to which a larger pot was given, is more than six feet high, with branches extending five feet wide, and a stem, the growth of a single year, exceeding, at its base, an inch in diameter. To obtain fruit of this species within the narrow limits of a forcing-house, it would be necessary to propagate from buds, or grafts, taken from the extreme branches of trees of considerable age.

The Mammee Tree (Mammea Americana).—Very contrary to my expectations, this plant, a native of Jamaica, proved extremely impatient of heat and light; and its young leaves always required to be shaded, when the temperature of the house exceeded 90°. But with proper

per attention to screen the leaves from the mid-day sun, till they acquired maturity, the young trees of this species have succeeded as well as those of any of the preceding species.

Several other plants, part of them natives of temperate climates, grew in my house, through the whole summer, without any one of them being drawn, or any way injured, by the very high temperature to which they were occasionally subjected; and from these, and other facts which have come within my observation, I think myself justified in inferring that in almost all cases in which the object of the cultivator is to promote the rapid and vigorous growth of his plants, very high temperatures, provided it be accompanied by bright sunshine, may be employed with great advantage; but it is necessary that the glass of his house should be of good quality, and that his plants be placed near it, and be abundantly supplied with food and water. In the preceding experiments, water was made the vehicle of food to the roots of the plants in the manner I have described in a former communication *, and with similar good effects.

My house contains a few pine-apple plants, in the treatment of which I have deviated somewhat widely from the common practice, and, I think, with the best effects; for their growth has been exceedingly rapid, and a great many gardeners who have come to see them, have unanimously pronounced them more perfect than any which they had previously seen. But many of the gardeners think that my mode of management will not succeed in winter, and that my plants will become unhealthy if they do not perish in that season; and as some of them have had much experience, and I very little, I wish at present to decline saying more relative to the culture of that plant.

* Horticultural Transactions, vol. II. p. 127.

Upon the Culture of the Pine-Apple, without Bark, or other Hot-bed. By THOMAS ANDREW KNIGHT, Esq. F. R. S., &c. President.

From the TRANSACTIONS of the LONDON
HORTICULTURAL SOCIETY.

IN a communication which I had the honour to send to the Horticultural Society in the last autumn*, upon the effects of very high temperature, when accompanied by very bright sunshine, upon some species of plants, I mentioned that I had made a few, apparently very successful, experiments upon the culture of the pine-apple: but I declined, at that period, to describe the means I had used, because several experienced gardeners in the vicinity were of opinion that my plants could not be made to survive, in health at least, the winter. The same gardeners have since frequently visited my hot-house, and they have unanimously pronounced my plants more healthy and vigorous than any they had previously seen: and they are all, I have good reason to believe, zealous converts to my mode of culture.

I had no intention whatever to attempt to raise pine-apples till the autumn of 1818, when I received from one of my friends in this vicinity, Mr. Ricketts, of Ashford Hall, some seeds of the mango, and soon afterwards some more seeds of that and other tropical fruit-trees, from one of our members, Mr. Pallmer. I then resolved to erect a hot-house, chiefly for the purpose of attempting to cultivate the mango; but I had long been much dissatisfied with the manner in which the pine-apple plant is usually treated, and very much disposed to believe the bark bed, as Mr. Kent has stated it in our Transactions, "worse than useless," subsequently to the omission of

* See the preceding Paper.

roots by the crowns or suckers. I therefore resolved to make a few experiments upon the culture of that plant; but as I had not at that period, the beginning of October, any hot-house, I deferred obtaining plants till the following spring. My hot-house was not completed till the second week in June, at which period I began my experiment upon nine plants, which had been but very ill preserved through the preceding winter by the gardener of one of my friends, with very inadequate means, and in a very inhospitable climate. These, at this period, were not larger plants than some which I have subsequently raised from small crowns (three having been afforded by one fruit), planted in the middle of August, were in the end of December last; but they are now beginning to blossom, and, in the opinion of every gardener who has seen them, promise fruit of great size and perfection. They are all of the variety known by the name of Ripley's queen-pine.

Upon the introduction of my plants into the hot-house, the mode of management, which it is the object of the present communication to describe, commenced. They were put into pots of somewhat more than a foot in diameter, in a compost made of thin green turf, recently taken from a river side chopped very small, and pressed closely whilst wet into the pots; a circular piece of the same material, of about an inch in thickness, having been inverted unbroken, to occupy the bottom of each pot. This substance, so applied, I have always found to afford the most efficient means for draining off superfluous water, and subsequently of facilitating the removal of a plant from one pot to another, without loss of roots. The surface of the reduced turf was covered with a layer of vegetable mould obtained from decayed leaves, and of sandy loam, to prevent the growth of the grass roots.

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The pots were then placed to stand upon brick piers, near the glass; and the piers being formed of loose bricks (without mortar), were capable of being reduced as the height of the plants increased. The temperature of the house was generally raised in hot and bright days, chiefly by confined solar heat, from 95° to 105° , and sometimes to 110° , no air being ever given till the temperature of the house exceeded 95° ; and the escape of heated air was then only in a slight degree permitted. In the night the temperature of the house generally sunk to 70° , or somewhat lower. At this period, and through the months of July and August, a sufficient quantity of pigeon's dung was steeped in the water, which was given to the pine plants, to raise its colour nearly to that of porter, and with this they were usually supplied twice a day in very hot weather; the mould in the pots being kept constantly very damp, or what gardeners would generally call wet. In the evenings, after very hot days, the plants were often sprinkled with clear water, of the temperature of the external air; but this was never repeated till all the remains of the last sprinkling had disappeared from the axillæ of the leaves.

It is, I believe, almost a general custom with gardeners, to give their pine plants larger pots in autumn; and this mode of practice is approved by Mr. Baldwin *. I nevertheless cannot avoid thinking it wrong; for the plants at this period, and subsequently, owing to want of light, can generate a small quantity only of new sap; and consequently the matter which composes the new roots, that the plant will be excited to emit into the fresh mould, must be drawn chiefly from the same reservoir, which is to supply the blossom and fruit; and I have found that

* Baldwin's Practical Directions for the culture of the Ananas, p. 16.

transplanting

of any other description ; and as it is the only farm upon which lime has been used as a top-dressing for wheat that I have ever heard of, except that occupied by the author of the treatise above alluded to, I cannot speak (either from my own knowledge or report) to its use upon light soil, particularly as I do not recollect whether the author had tried it upon that description of soil.

3. Has it been tried both upon drilled and broadcast crops, and succeeded equally with both ?

Ans. As Mr. Shafto has for many years past, been in the habit of drilling all his wheat, no trial has been made upon broadcast crops ; but, undoubtedly, the practice is much better adapted to the drill system ; because, after the lime has been applied on the young wheats, which is done sometime between the beginning of January and the end of February, or as soon afterwards as the state of the land will admit, the horse-hoe is, no doubt, of great use in being run through the drilled wheats in the month of April, or early in May ; by which operation the lime becomes mixed with the surface soil, and it gives the clover and grass-seeds (which are always sown when this operation is going on), such a cover as nothing else could do ; and there is every reason to believe, that the superiority of Mr. Shafto's clover crops is, in a great measure, owing to this practice.

4. What is the exact time for applying the lime, and what sort is preferred ?

Ans. The lime can only be applied when the land is sufficiently dry or frosted, to admit of the carts going upon it without cutting. Any time between the first of January and the end of February is considered a good time. It has sometimes been applied a little earlier, and sometimes a little later. The sort used at Whitworth has been the magnesian lime from Westerton and Counden,

Counden, being of the Eastern formation of this county.

I believe its constituents are,

Carbonate of lime, about	53.
Carbonate of magnesia, about ..	44.
Insoluble matter, about	1.5
Loss, about	1.5
	100.

This lime has not by any means been chosen in preference to any other kind; it has been used because of its being nearer by twelve miles, than that of the Western formation in this county.

5. How much is given *per acre*, and in what manner is it applied?

Ans. Eighty bushels *per acre* (measured when in the clod, in an unslacked state) have generally been applied. As to the manner of preparing and applying it, the lime is brought from the kilns sometime in the latter part of summer, and laid in large heaps of 160 to 600 or 800, or even more bushels each, according to the size and shape of the fields. After the lime becomes fallen by the dews and rains, it is put up into more compactly shapen heaps, so as not to receive too much water. These heaps are turned two or three times during the autumn and early part of winter, and applied as noticed in the answer under the fourth query.

6. Has it any immediate effect upon the wheat plant, and is it incompatible with a crop of clover, &c. after the wheat?

Ans. No *immediate* effect upon the wheat plants has been perceived; but it certainly is highly compatible with the succeeding crop of clover, as mentioned in the answer to the third query, and consequently to the oats, or whatever crop may succeed the clover.

7. Has its efficacy, as a corrective of mildew, been established by any strong facts; and has any experiment been tried to ascertain it?

Ans. No actual experiment has been tried by liming parts of a field and omitting to do other parts, &c.; but before the use of lime as a top-dressing for wheat was resorted to by Mr. Shafto, the wheats on the demesnes farm were more or less affected in certain seasons, much the same as the rest of the wheats in the parish of Whitworth and neighbourhood; but it is a fact, that, since its use, the wheat has not at all been mildewed, though other wheat crops in the neighbourhood have suffered at times as usual.

A Method of casting the Characters used in Printing in solid Forms or Plates. By M. HARRAW.

FROM DESCRIPTION DES BREVETS D'INVENTION.

THIS process consists, first, in making moveable characters, the body of which has the form and size of common types, but which, instead of bearing a projecting character turned towards the left, have, on the contrary, a hollow or sunk impression, or engraved character turned towards the right, always exactly of the same depth; secondly, in uniting firmly these characters (which the inventor calls *moveable matrices*) into pages, so as to leave no interval between them; their arrangement being made in the usual method of composing types, and differing only in this, that they are placed in a contrary direction, namely, from left to right; thirdly, and lastly, in casting a solid plate from these united matrices with the greatest neatness.

*Analysis of the triple Phosphate of Ammonia and Soda,
and of the triple Sulphate of the same Bases.*

By M. ANATOLE RIFFAULT.

From the *ANNALES DE CHIMIE ET DE PHYSIQUE.*

MR. Mitscherlich, in his interesting *Memoir on Crystallization*, has deduced the composition of the phosphate of soda and ammonia; not so much by accurate chemical analysis as by theoretical deductions, since, of the four elements of which it is composed (namely, the three above mentioned, and water of crystallization), two have been determined by calculation, and according to inferred laws of the composition of double salts, which have not yet been confirmed by a sufficient number of examples. As the composition of this salt, laid down by former chemists, was in manifest contradiction to the effect produced on it by the action of fire, I determined to examine it anew, and the results will be found to bear a striking coincidence with those of Mr. Mitscherlich, and to furnish another confirmation to the law of composition which he has assumed.

A considerable quantity of this salt was first prepared according to the method given by Berzelius, in his *Treatise on the Blow-pipe*, that is, mixing hot solutions of phosphate of soda with muriate of ammonia, by which, on cooling, the triple phosphate deposits in beautiful prisms. This was purified by repeated crystallizations, taking care at each process to add a little ammonia, to supply the place of that which is always lost by the solution in hot water. The salt being thus obtained quite
pure,

pure, it was dried spontaneously in the open air on filtering-paper.

The pure salt being thus prepared, 100 grains were heated to redness, for a full half hour, in a platina crucible, and the loss of weight noted. The same was repeated twice. In the first experiment the loss was 51.200; in the second 50.401; and in the third 50.302; the mean of the three is 50.634, which, therefore, may be assumed as the quantity of water and ammonia in 100 parts of this salt.

3.036 grammes of the same salt were dissolved in cold water, and the solution precipitated by muriated barytes, added in excess. This excess being then decomposed by carbonated ammonia, all the soluble salts, together with the washings of the barytic precipitate, were evaporated to dryness, and ignited to redness, to expel the muriate of ammonia formed in the process. The remaining fixed salt was muriate of soda; the alkali of which was furnished by the 3.036 gr. of triple phosphate, and amounted to 0.453 gr.

In a second similar experiment the muriate of soda was subsequently converted into 1.002 gr. of dry sulphate of soda, of which the soda amounts to 0.450 gr.

The mean of these two experiments gives 14.875 of soda in 100. of the triple phosphate.

To ascertain the ammonia, 0.5 gr. of the triple salt was mixed with peroxyd of copper, and heated in a glass tube. The azotic gas collected in the process would amount to 0.0378 gr. in weight, equivalent to 0.0461 gr. of ammonia, or 9. parts in 100. of the triple salt.

Deducting the weights of the soda thus found, from the entire residue of the salt, after the expulsion of the ammonia and the water of crystallization by heat,
the

the remainder may be estimated as phosphoric acid. The whole analysis, therefore, will give the following results in 100. parts.

Phosphoric acid	34.491	or	
Soda	14.875	Phosphate of soda ..	31.999
Ammonia	9.000	Phosphate of ammonia	26.377
Water	41.634	Water	41.634
	100.000		100.000

Now, if we enquire theoretically, what would be the composition of this triple salt, we shall find the following close approach to actual experiment :

1 atom of neutral phosphate of soda..	84.120	or	31.981
1 atom of phosphate of ammonia ..	66.480		25.274
10 atoms of water	112.430		42.745
	263.030		100.000

This coincidence is quite as close as could be expected, after making due allowance for errors, which must always occur in actual experiment, and the result is the same as that which is given by M. Mitscherlich.

The analysis which Fourcroy has given of the triple phosphate of soda and ammonia, or microcosmic salt of urine, gives results so widely different from the present, that we cannot doubt that they are two distinct species of salt ; which opinion is strengthened by the observation, that the numbers given by this eminent chemist coincide almost exactly with the supposition that the salt employed by him contains one atom of sub-phosphate of soda, one atom of sub-phosphate of ammonia, and three atoms of water ; and this salt is changed by calcination into neutral phosphate of soda.

Sulphate

Sulphate of Soda and Ammonia.

Ammonia, which has so great a tendency to form salts with double bases, produces with sulphate of soda one of these species of compounds, which is easily obtained by evaporation of the compound solution. This triple salt forms large well-defined crystals, which do not at all effloresce at an ordinary temperature.

4.98 gr. of this salt, dried by long exposure to the air, were dissolved in water, and precipitated by a solution of muriate of barytes of known strength; whence the real sulphuric acid contained in the salt was estimated at 2.280 gr., or 45.74 *per cent.*

5.050 gr. of the same salt were heated in a crucible: the mass did not immediately liquify, as sulphate of soda does, in its own water of crystallization, shewing therefore a less proportion of this ingredient; on increasing the heat, ammonia first escaped in abundance, and then sulphuric acid, and after the salt had been strongly heated for a time, nothing remained but 2.129 of neutral sulphate of soda, or 42.360 *per cent.*

A second similar experiment made upon 5.970 gr. of the triple salt left 2.524 of the neutral sulphate, or 42.298 *per cent.*; and the mean of the two is 42.329 *per cent.* of neutral sulphate.

The proportion of ammonia was estimated in the usual manner, by the quantity of azote obtained on heating the salt with peroxyd of copper, 0.5 gr. of the triple sulphate produced, after all corrections had been made, 0.0396 gr. of azote gas, which represent 0,04839 of ammonia, or 9.678 *per cent.* in the triple salt.

Now, according to the proportional numbers which we have adopted, 42.329 of sulphate of soda contain

18.55 of base, which therefore will give for the composition of the triple sulphate of soda and ammonia, according to this analysis, the following numbers :

Soda	18.550	or	
Ammonia	9.678	Sulphate of soda	42.289
Sulphuric acid	45.740	Sulphate of ammonia	31.729
Water	26.032	Water	24.032
	<u>100.000</u>		<u>100.000</u>

If the theoretical composition of this salt be stated at one atom of sulphate of soda, one atom of sulphate of ammonia, and five atoms of water, it will give

Soda, 1 atom	39.092	or	18.016
Ammonia, 1 atom	21.450		9.887
Sulphuric acid, 2 atoms	100.232		46.193
Water, 5 atoms	56.215		25.904
	<u>216.989</u>		<u>100.000</u>

On the Metallic Thermometer of M. BRÉGUET, and on the Method of establishing its Correspondence with other thermometrical Instruments. By M. DE PRONY.

FROM ANALYSE DES TRAVAUX DE L'ACADÉMIE DES SCIENCES.

IT is known that rods of iron, copper, silver, gold, platina, &c. the lengths of which are equal at a certain temperature, become unequal when that temperature changes; and as the same variations are reproduced in the same circumstances, the measures of the inequalities of length, corresponding with the different temperatures, may furnish a means of thermometrical valuation; but the extreme smallness of the ratio between the inequalities of the lengths themselves, renders precision difficult to obtain.

M. Bréguet has eluded this difficulty, by substituting the measure of angles for that of lines. By this substitution he has succeeded with an instrument of small volume and convenient use, not only in rendering the phenomena easily and perfectly sensible, but also in indicating them with a rapidity far beyond that of mercurial thermometers. M. Bréguet's thermometer, the construction and properties of which are founded on the differences existing between the dilatability of the metals by its sensibility, shew, almost instantaneously, the slightest change of temperature occasioned in a gas or liquid in which it is immersed.

These advantages are obtained by soldering together flattened wires, and turning them into cylindrical spirals or helices, that is to say, by giving them the form of bell-springs. This procedure is similar to that which M. Bréguet employs for the spirals or balance-springs of his time-keepers.

This

This new thermometer thus experiences, without any intervening substance, the temperature of the medium in which it is placed. Two metals might be sufficient for making the instrument; but this union of two metals only will not give all the perfection desirable. M. Bréguet is accustomed to form his spirals of three different metals—silver, gold, and platina, in the state of greatest purity. He places inside and outside the metals of the greatest and the least expansibility, and between these the other metal of the mean expansibility. The horizontal circle perpendicular to the axis of the helix, which passes through its centre, is divided into 100 parts. The thickness of the three flat wires together is only one-twenty-fifth of a millimetre ($=0.002$ inch) at the most. Hence it is obvious with what facility and promptitude caloric must enter the system of these three metals, on which it acts without being obliged to traverse previously an intermediate substance. Experience has further proved, that to this great sensibility is united all the precision desirable in measure. The angular progress of the needle can be measured with great exactitude, and it has been found that the differences between the angles described were conformable to the progressive variations of the temperature. M. de Prony has verified this identity of ratios by a series of observations during two years, in which are included the low temperature of the winter of 1819 to 1820. The same temperatures constantly brought the needle back to the same point. The instrument of comparison was an excellent mercurial thermometer by Fortin.

The trial, and in general the use of the metallic thermometer, requires certain precautions. It is a delicate instrument, which must be handled and moved with care, protecting the helix from pressure and from blows, which,

without being strong, might alter the curvature and change the march of the instrument. This helix should also be held in a very still air, as the slightest wind will make it oscilate*.

A new Steam-Engine. By M. DE MONTGÉRY.

From the *ANNALES DE L'INDUSTRIE*.

IN this engine, purified bitumen, after having served in the form of vapour, serves as combustible. The fire-place, the pipes and mechanism are contained inside the boiler, which is itself inclosed in a double case. The vapour may, therefore, be raised to a very high degree of tension, without danger, and this advantage, joined to several others, renders the bulk of this new machine from forty to fifty times smaller than that of the present steam-engines of equal power.

* Any unity of length of gold at 32° Fahrenheit, is increased to 1.0015 nearly to 212°; of platina, to 1.00085655 (Borda); of silver, to 1.00191; of brass, to 1.0019. See Biot's *Traité*, I. 159.

To measure a base-line between Melun and Lieurgain in France, Borda used a compound bar of brass (*cuivre*) and platina, 12 feet long. The two flat bars were fastened together at one end and free at the other; and the platina a little exceeded the length of the brass. At the free extremity, on the platina, a scale was marked, the divisions being millionths of the whole length of that bar; and the free extremity of the brass bar, lying on the platina, was divided to serve as a vernier to the scale before mentioned, and carried a microscope for reading off. By these means the temperature of the compound bar was known at all times, from the expansion and from the ratio of the absolute dilatibility of the two metals of which it was formed. *Ib.* 164.—Tr.

Note

*Note on certain Phenomena exhibited in the Burning of
common and artificial Lime.*

By M. VICAT, Engineer of Bridges and Highways.

From the *ANNALES DE CHIMIE ET DE PHYSIQUE*.

ABOUT ten years since, in burning in a small stove some fragments of pure calcareous stone intermixed with charcoal and pit coal, I observed, that when the furnace was re-charged with the same fragments, as they fell into the ash-hole, and repeatedly burnt, by adding fresh fuel, a *dead lime* was produced incapable of being slaked, but which, when ground and mixed in the manner of plaster, had the remarkable property of setting under water.

This phenomenon appears consistent with an old opinion common to master lime-burners, that it is impossible to form into lime, that stone which has cooled before it has been sufficiently burnt. Now the dead lime I have obtained is really in the same case, since the calcareous fragments were not entirely burnt, in consequence of their falling into the ash-hole, and having become cold by the time they were again put into the furnace.

From this it appears that a calcareous matter nearly pure, such as chalk or marble, can be reduced to a middle state by fire, *viz.* that of being neither lime nor carbonate of lime, and has the property when pulverised and mixed to the consistency of paste, of solidifying under water.

It is well known that chalk when converted into lime, and slaked in the usual manner, gives an hydrate which does not harden in water; but if the same lime be suffered to fall spontaneously into a powder by long exposure to the air (in a sheltered place), and be afterwards tempered with a little water to form it into a stiff paste,
this

this paste will solidify very sensibly after immersion. The action of the air, therefore, in this case, gives place to a new combination, which seems analogous to that of chalk imperfectly burnt, inasmuch, that being neither completely lime nor completely carbonate, it possesses the same hydraulic properties.

In trying lately to calcine pulverised lime-stone in the manner I have proposed formerly, for the fabrication of artificial puzzolana, the results placed in a new light the phenomena above mentioned. I divided into ten equal portions a certain quantity of very fine powdered chalk; the first portion thrown upon a red-hot plate of cast-iron, was calcined in three minutes; the second remained six minutes; the third nine; and so on in succession until the last; which was consequently half an hour. During each operation the powder was well stirred in every direction, in order to favour the equal operation of the heat; the ten portions thus calcined, were kneaded with a very little water, and reduced to a firm paste of an equal consistency. During this manipulation no sign of slaking or increase of bulk took place; the first portions exhaled the usual smell of tempered chalk, but the latter portions gave marked indications of causticity in addition to the alkaline smell which is peculiar to lime.

All the portions, except the first, hardened after twenty-four hours immersion in water, like the hydraulic limes; at the end of four days a knitting-needle, one millimètre in thickness, terminating in an obtuse point, and having a button of lead, weighing 0,^k131 fixed to the other end as a weight, did not enter it deeper than from 3 to 5 millimètre; and at the end of twelve days, the mean depression was from 0,^m0008. The first portion that had been calcined in the short space of three minutes remained constantly soft.

I shall

I shall at present only observe that the difference of resistance to the proof needle of the 2d portion, which took only six minutes to calcine, and the 10th, which took thirty minutes, was hardly appreciable; and, finally, the commencement of this solidification is so similar to that of the hydraulic limes, that I have thought it proper to give the information to the administration of bridges and highways, in order that, in the different experiments on lime-stones which are now making in France, the results that proceed from burning in the small way, may not be entirely depended upon.

If we consider hydrate of chalk imperfectly burnt, and pure lime spontaneously slaked, each as being mixtures in different proportions of particles of lime and particles of carbonated lime, it may lead us to believe that it is possible to imitate these supposed mixtures exactly, simply by adding directly to the chalk powder a certain quantity of lime. Yet, in all the experiments that I have made in this manner, with from 100 to 500 parts of chalk, to 100 of lime recently slaked, there were none which when plunged in water, gave the least sign of solidification: whence proceeds this difference?

M. Raucourt de Charleville, an engineer of bridges and highways in the service of Russia, in repeating on the northern limes experiments analogous to mine on the limes of France, obtained results which bore a very near relation to the preceding. Having mixed pure lime with a suitable quantity of clay, and reduced the dried mixture into fragments the size of a pea, he divided it into three portions, and subdivided these into four parts each; these portions were afterwards burnt in the manner indicated by the following table, which also contains the results:

First

190 *On certain Phenomena in the burning of Lime.*

First Series.—Portions burnt on a Plate of Cast-iron made red-hot

Number.	Time of burning.			Colour after burning.	Consistence.	Heat disengaged by mixing with water.	Time in setting under water.
1	0	Hours	25	Brick,	Friable,	none,	3 days.
2	0	—	50	<i>id.</i> deep,	<i>id.</i>	Hardly sensible,	12 hours.
3	0	—	75	<i>id.</i> deep,	<i>id.</i>	<i>id.</i>	24 hours.
4	1	—	00	Reddish black,	<i>id.</i>	<i>id.</i>	4 days.

Second Series.—Burnt in a Stove.

5	0	—	25	Yellowish,	Friable,	Very sensible,	2 days.
6	0	—	50	<i>id.</i>	<i>id.</i>	Still more,	15 hours.
7	0	—	75	Reddish,	Less.	Very sensible,	10 days.
8	1	—	00	Clear yellow,	<i>id.</i>	Little,	15 days.

Third Series.—Burnt in contact with Charcoal.

9	0	—	25	Clear yellow,	Friable,	Much,	A month.
10	0	—	50	Deep yellow,	Hard,	Little,	never.
11	0	—	75	Greenish do.	Very hard	<i>id.</i>	<i>id.</i>
12	1	—	00	<i>id.</i>	vitrified,	Insensible,	<i>id.</i>

No. 2 of the first series and No. 6 of the second afforded the most advantageous results; yet they differed essentially in this respect, that one appeared to possess the characters of a dead lime or of *Roman* cement, while the other exhibited those of a natural hydraulic lime, both in its colour and its slaking with water. But the third series were the most remarkable; it was evident that the contact of the charcoal deranged the re-action, which takes place between the lime and clay in the ordinary mode of burning, and it does not appear easy to explain the phenomenon; what part, indeed, can be assigned to the oxygen, in this case, in respect to the lime, the silex, and the alumine? If it act only on the iron, we may believe that it must pass from the state of peroxyd, before it can combine with the lime, and that the charcoal prevents it; but the iron is in fact nearly passive, as the experiments of M. Berthier prove. The
theoretical

theoretical solution of these difficulties, appears to me to be of as much importance to the particular history of lime as to that of mortar. It is much to be desired that some chemist more practised than myself, and with more leisure, would repeat the experiments which are the object of this note, and dispel the doubts to which they have given rise.

List of Patents for Inventions, &c.

(Continued from Page 128.)

THOMAS GREENWOOD, of Gildersoun, near Leeds, Machine-maker, and JOSEPH THACKRAH, Surgical-mechanist, of Leeds, both in the county of York; for certain improvements on, or substitutes for, pattens and clogs. Dated December 27, 1823.

JOHN VALLANCE, of Brighton, Sussex, Esq.; for an improved method or methods of freezing water. Dated January 1, 1824.

FRANCIS DEVEREUX, of Cheapside, London, Merchant; for certain improvements on the mill or machine for grinding wheat and other articles, commonly known by the name of the French Military-mill. Dated January 8, 1824.

JOSEPH FOOT, of Charles-street, Spitalfields, Middlesex, Silk-manufacturer; for an improved umbrella. Dated January 15, 1824.

JOHN WHITE, of the New Road, Mary-le-Bone, Middlesex, Architect; for a floating break-water. Dated January 15, 1824.

JOHN FINLAYSON, of Muirkirk, Airshire, Farmer; for certain improvements on ploughs and harrows. Dated January 15, 1824.

JEAN

JEAN LE GRAND, of Lemon-street, Goodman's-fields, Middlesex, Vinegar-manufacturer; for certain improvements in fermented liquors, and the various products to be obtained therefrom. Partly communicated to him by a certain foreigner residing abroad. Dated January 15, 1824.

WILLIAM GUTTERIDGE, of Dean-street, St. Fin Barrs, Cork, Musician and Land Surveyor; for certain improvements on the clarinet. Dated January 19, 1824.

GEORGE POLLARD, of Rupert-street, St. James's, Middlesex, Brass-founder; for certain improvements on machines or machinery for levigating or grinding colours used in the various branches of painting; which machinery may be worked by any suitable power, and is applicable to other useful purposes. Dated January 19, 1824.

JAMES RUSSELL, of Wednesbury, Staffordshire, Gas Tube-manufacturer; for an improvement in the manufacture of tubes for gas and other purposes. Dated January 19, 1824.

SIMEON BROADMEADOW, of Abergavenny, Monmouthshire, Civil Engineer; for a new and improved method of manufacturing and purifying inflammable gases, by the admission and admixture of atmospheric air. Dated January 19, 1824.

HOWARD FLETCHER, of Walsall, Staffordshire, Saddlers'-ironmonger; for certain improvements in tanning hides and other skins. Dated January 19, 1824.

THE
REPERTORY
OF
ARTS, MANUFACTURES,
AND
AGRICULTURE.

No. CCLXII. SECOND SERIES. March 1824.

Specification of the Patent granted to GEORGE STEPHENSON, of Killingworth, in the County of Northumberland, Engineer; for certain Improvements in Steam-Engines. Dated March 21, 1822.

With an Engraving.

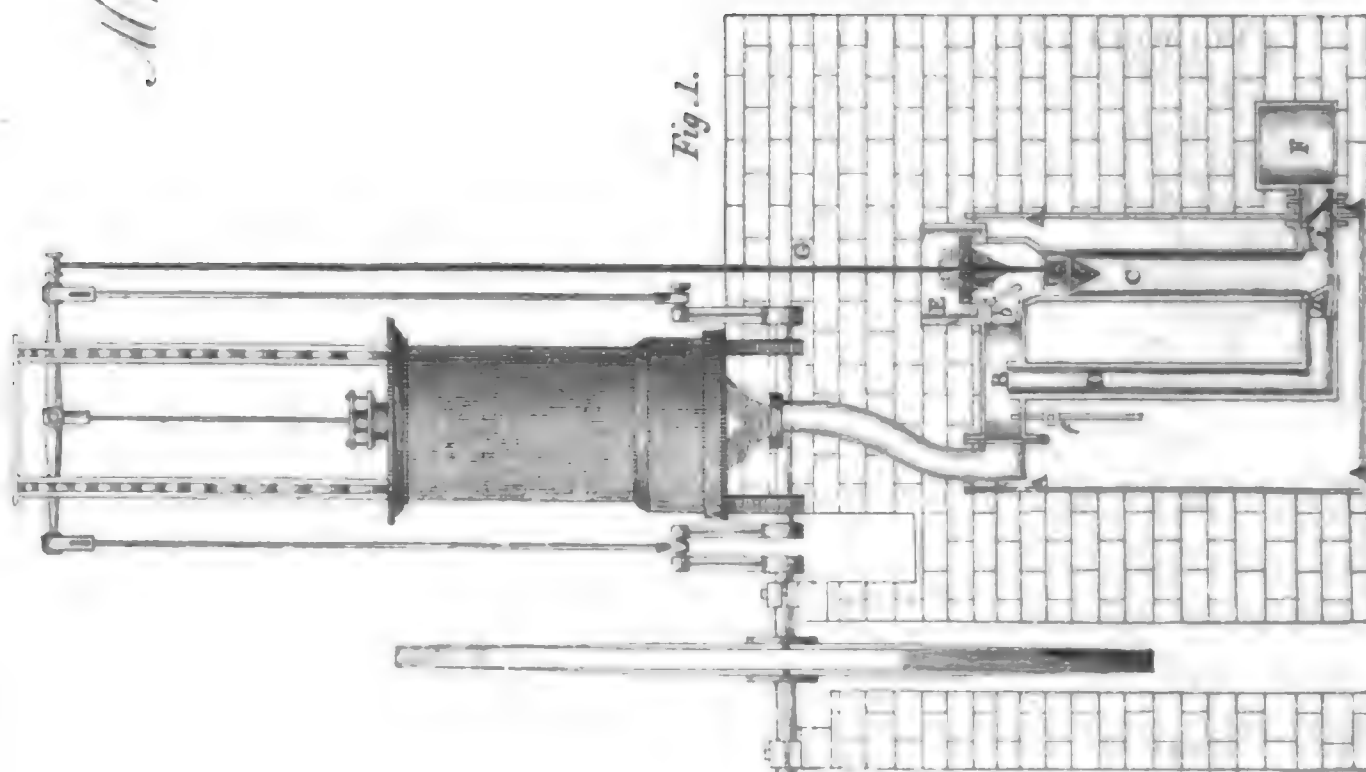
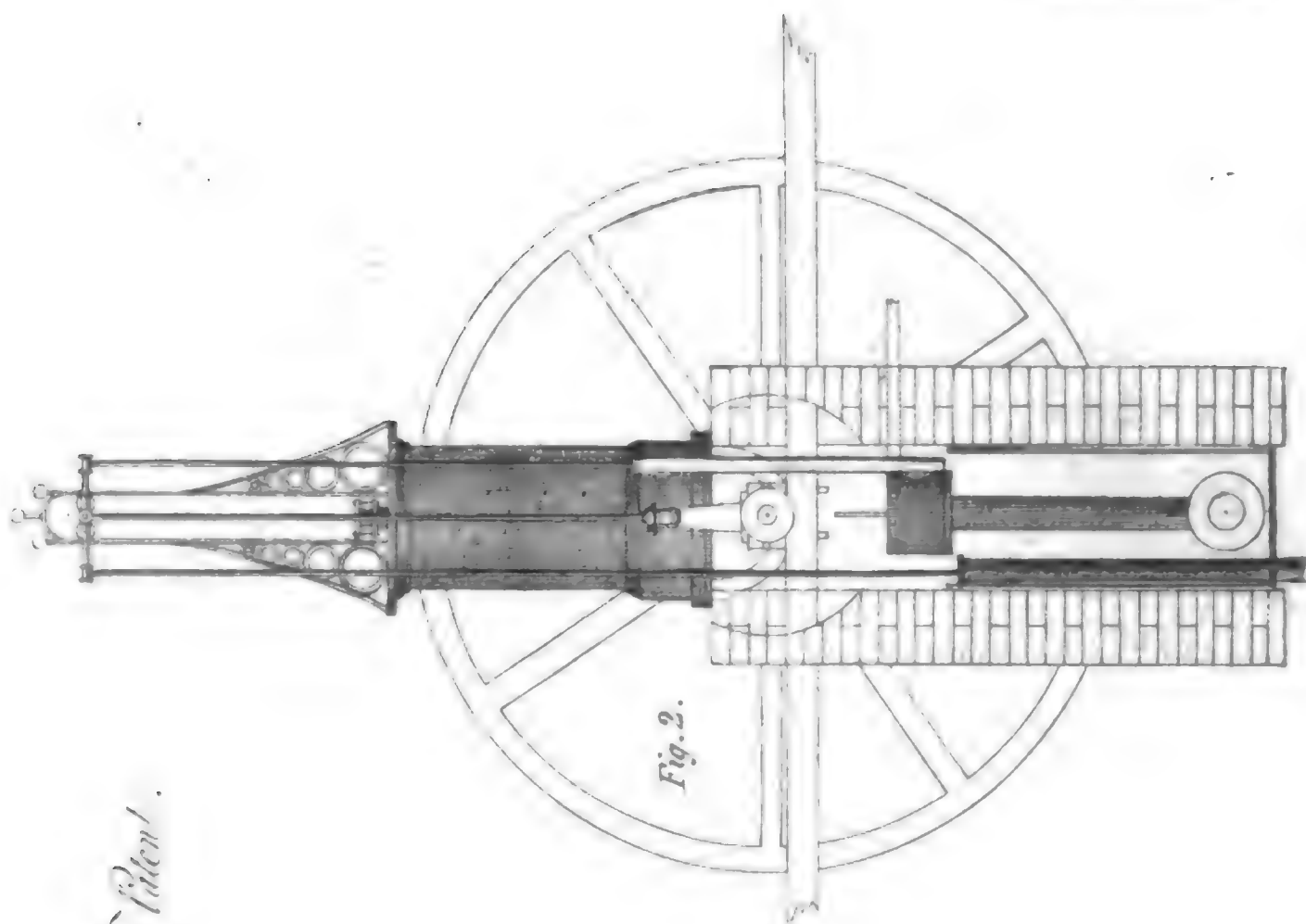
TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said George Stephenson do hereby declare that the nature of my said invention, and the manner in which the same is to be carried into effect, are particularly described and delineated in and by the figures and drawings in the margin of these presents, and by the following description thereof; that is to say: It may, perhaps, tend more clearly to illustrate my improvement to point out the defects of the present mode, and to shew wherein they are obviated by my invention. Now, my invention consists of a method or methods of producing a more perfect vacuum than has hitherto been done in the condenser, consequently in the cylinder of a

single or double-powered Bolton and Watt's engine, or other engine, where a condenser is used, or where the condensation is performed in a vessel separate from the cylinder. And I hereby declare, that the same may be carried into effect in the following manner; that is to say :

Fig. 1 (Plate X.) represents a side view of a construction of my invention. A, A, A, A, shew the cold-water-cistern, within which is the condenser B, wherein the steam is condensed by a jet of cold water thrown in by the pipe *f*. C is the air-pump, worked by a solid plunger *e*, attached to the cross-bar or beam of the engine by the rod G. *a* and *b* are two clacks, or hanging valves, for opening and shutting off the communication between the air-pump and the condenser. *i* is a similar valve, through which the water is discharged from the underside of the plunger into the hot well F; and *o* is a loose wooden cover, on the top of the air-pump, for discharging the water and air from the upper side of the plunger into the hot well E. The communication-pipe D is made to project a little into the condenser, so that a part of the condensing water is made to flow upon the plunger in its descent, and which ought to be sufficient to occupy the space between the wooden cover *o* and the plunger, when the latter is at the summit of its ascent. This space would otherwise contain air or vapour of the same density with the external atmosphere, and which would materially injure the purity of the vacuum in the condenser. *g g* are inverted cones, respectively fixed to the under side of the wooden cover *o* and plunger *e*, which prevent the abrupt contact with the water in the ascending and descending stroke of the piston or plunger. To obtain a perfect vacuum in the condenser of a steam-engine is a desideratum of great value, as the want of it lessens



Mr. Stephenson's Patent.



lessens the effect of the engine, whilst every little approximation towards it increases the effect, without in the least adding to the cost or expense of working the engine. The method of condensing the steam in a vessel separate from the cylinder is generally considered an invention of the ingenious Mr. Watt, and has since his improvements undergone little or no alteration. This method is effected by means of a vessel, distinct from the cylinder, and called the condenser, into which the steam is allowed to flow at every half stroke of the double-powered engine, and at every whole-stroke of a single-powered engine, and is condensed by a jet of cold water; which water, together with the air that unavoidably penetrates the packing and joints, or is extricated from the water, is pumped out by means of an air-pump. The construction of the air-pump and condenser on Bolton and Watt's principle, being so well known, it will be unnecessary to enter into a minute description of them; only, it may be necessary to state, that the air-pump and condenser are supposed to stand near each other, with a communication between them at the bottom, shut off occasionally by a hanging valve.

I shall proceed to consider the action of this apparatus immediately after the condensation is effected, by the jet of cold water entering into the condenser; this water will then fill the communication-pipe, and ascend to a certain height within the condenser, above which the air and some steam remaining uncondensed will be resting. Suppose the air-bucket begins to ascend, a vacuum will be found beneath it, and the water, pressed upon by the elasticity of the air and vapour in the condenser, is impelled through the hanging valve to follow the bucket in its ascent. Now as the air, from its inferior specific gravity, will not descend through the water, it is evident that
the

the water must be forced out of the condenser, until the air obtains a passage along the roof of the communication-pipe, until it comes perpendicularly beneath the column of water in the air-pump, where it will, by its specific levity, ascend through the water, and occupy a space immediately underneath the falls of the air-bucket, and will, when the bucket has gained its full ascent, be discharged, in the next stroke of the engine, through the upper valve into the hot-well. It follows then, that the air or other steam in the condenser will always be of that elasticity which is required to support a column of water corresponding with the size of the air-pump, and the quantity of injection-water used; hence the vacuum is always found to be far from perfect. But this is not the only imperfection in this mode. In steam-engines where the bucket moves with great velocity, as in winding-engines, the sudden impulse of the bucket upon the water in descending, soon destroys that accuracy and nicety requisite in this part of the steam-engine, and still further tends to render the vacuum imperfect.

I shall now explain the operation in my invention: when the condensation is effected, the water, by its superior gravity, will immediately fall to the bottom of the condenser, the air and vapour resting upon the upper part. Suppose in this situation the plunger to be at the bottom of the pump and beginning to ascend, leaving a vacuum below it, the water in the condenser will flow down and along the communication-pipe through the valve *a*, and follows the plunger so far in its ascent, until it (the water) finds its equilibrium with that remaining in the condenser. On the return of the plunger, the valve *a* shuts and the valve *i* opens, and the water is forced into the hot-well *F*; and as the plunger descends, a vacuum is made above it, the valve *b* then opens, and allows the

the air and elastic vapour to occupy the space above the plunger, which in its re-ascent shuts the valve *b*, and discharges the whole through the loose cover *o* into the hot-well *E*; here then it will be seen that the air or vapour having no obstruction in entering the vacuum above the plunger, except what arises from the resistance of the hanging valve *b*, which is made to move very freely, the vacuum must be considerably more perfect than the mode heretofore used, and will approximate very nearly to that of the barometer. Hence, then, my invention consists of a method of discharging the air and water from the condenser, by the action of a double pump, in such a manner that the air in its escape from the condenser meets with scarcely any sensible obstruction from the condensing water; the air and water being so distinctly separated, that the discharge of the former is effected chiefly by the ascent, and the discharge of the latter by the descent, of the plunger. In the annexed drawings I have shewn my apparatus, with its application to a steam-engine, where the air-pump is made to work the whole length of the stroke of the engine, which, together with the action, both in the ascent and descent, will proportionably reduce the size of my air-pump. It is well known the present apparatus cannot be applied to work the whole length of the stroke of the engine, without proportionably decreasing the purity of the vacuum; but in my invention the increased length of stroke increases the purity of the vacuum, and further proves the superiority of the present invention. An engine on my plan may, from its simplicity of construction, be removed, and erected upon a smaller space and at considerably less expense than has hitherto been done.

In witness whereof, &c.

Specification

Specification of the Patent granted to Sir WILLIAM CONGREVE, of Cecil-street, Strand, in the County of Middlesex, Baronet ; for certain Improvements in the Manufacture of Bank-note Paper, for the Prevention of Forgery. Dated December 4, 1819.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Sir William Congreve do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in the following description thereof; that is to say: The object of this invention is to form certain tests of genuineness in the paper on which bank-notes are to be printed, which cannot be imitated after the paper is made, as is at present the case with the ordinary paper used for bank-notes; but which tests or distinguishing marks or peculiarities must indispensably be given to the paper, in its original construction or formation at the paper-mill, which no ordinary forger can accomplish, so that no forgery can be completed without the aid of paper-makers. And the object is, moreover, to make these tests or marks as simple as they can be, so that they may be immediately recognised and understood by the most unlearned persons, that all orders of people may be equally able to distinguish a bad note from a good one, by observing whether the said tests exist or not in any note that may be offered. Of these tests, and of the mode of producing them, there are various modifications and gradations, which I shall here specify.

First, the very texture, smoothness, and thinness of bank-paper, united with a new and peculiar degree of strength,

strength, and with a peculiarly transparent water-mark, so bright that it cannot be imitated either by friction, pressure, or varnish, may be made to form a test of genuine bank-paper, which can only be imitated in the original fabrication of the paper, and not subsequently. This smoothness and thinness are to be accomplished by a particular process in preparing the material, by mashing or rubbing the pulp to pieces instead of cutting it, by which the pulp is made of a fine long and flakey staple instead of a short nature, so that the texture of the paper becomes tough and elastic instead of being weak and brittle; this property also may be increased by the mixture of certain transparent vegetable and animal substances, such as gum, isinglass, parchment cuttings, and the like, by which a peculiar degree of tenacity and transparency is attainable; and the due proportions of which can best be regulated by the experiment of the workmen. This paper, when dipped singly, will afford a much more brilliant water-mark than ordinary paper, from the nature of the materials, which may be augmented, by forming the water-mark of very thin sheet copper or brass, instead of wire, or by mixing both. The water-mark, however, of such single colourless paper cannot be made permanently indelible. To accomplish this most desirable end therefore in white paper, by which a certain test may be obtained in such paper of its not being a forged water-mark, this paper must be dipped in a vat of the thinnest possible material twice for once touching it, and the transparency and distinctness of the water-mark will be improved by dipping the mould in clear water between the first and second dips in the pulp, by which means a permanent difference of thickness between the substance of the water-mark and of the plain part is created, whereas the ordinary water-mark is little more

more than an impression on the surface of the paper ; a note thus produced, though it need not, with the fine materials proposed, be thicker than an ordinary note, will on the whole be much stronger than the common note, because it will in fact be more close or dense in its texture, though not thicker. The tests of the genuineness of the white bank-note paper which I thus manufacture, are indeed extremely delicate and beautiful, but they are not of the same decided character and universal manifestation as those which I shall proceed to explain.

These are formed by the introduction of a coloured layer of pulp, in combination with white layers, and are thus effected. The material being prepared, and reduced into the finest possible pulps, as above stated, a mineral dye is added to one of them, or a vegetable dye will answer if the pulp be made of material previously dyed. Thus I have found the Adrianople red cloth form a most excellent coloured pulp, not only because the colour is peculiarly clear and permanent, but because it is a dye most difficult to give. The pulps being thus prepared, the following different modifications of this paper may be made, for the purpose of giving the test or mark required, and which is certainly not to be imitated, but by a similar process to that of the original manufacture. This paper should be made in two different moulds, one a plain one and the other with a water-mark, either as above of thin copper-plate, or wire, or both as follows.

First, by three dips and three couchings ; a dip of the white pulp being taken in the plain mould, is to be couched ; then a dip with the water-mark mould is taken of the coloured pulp, and that couched on the white ; and again, a third dip of white in the plain mould laid upon this. The layers of each pulp being taken as thin as possible, this completes the formation of the sheet, and

and the felt is then laid on. The paper thus produced contains a dyed or coloured layer, with a most brilliant, distinct, and permanent, or indestructable water-mark, between two thin layers of white, the colour therefore is in the heart of the paper, and is scarcely perceived until held up to the light. Now it is obviously impossible to place the colour thus in the interior, except in the first formation of the paper. No person can, after the paper is made, dye the heart of a sheet of paper without dyeing the exterior also; nor can there be any test of genuineness devised, whereof the proof can be more simple or self-evident than the having thus merely to ascertain the fact of the colour being in the interior of the paper, by holding it up to the light, and thence deducing that this paper must have been made under circumstances scarcely attainable by the forger; or indeed I may say, wholly unattainable by him if due attention be paid to the perfection of the manipulations in the original paper; since it would be impossible to produce the triple paper in such perfection, without working in large quantities and by very expensive and cumbrous machinery. The second mode of producing this paper is, by three dippings and two couchings. The triple paper made as above might be objected to for certain banks, on account of its being too thick. In that case, therefore, this paper may be made not as above, by three dippings and three couchings, but with three dippings and only two couchings. By dipping first in the coloured pulp, then the white upon it in the water-mark mould, then couching both these layers together, which brings the coloured layer uppermost; then dipping the second white separately in the plain mould, and couching it on the coloured layer. There is also a third mode of producing this paper by three dippings and only one couching. This is effected

by dipping first the white, then the colour, and then the white pulp again one upon the other in the same mould, and couching the three layers at once. These three different modes of combining this paper, give three different gradations of substance, whereof the latter is the thinnest, and also the most rapidly made; this latter, however, requires more dexterity in the workman, and is, perhaps, for that reason, the best calculated for the desired security, while its thinness places it still further from any spurious imitation that might be attempted, by pasting three sheets of thin ready made paper together. In those modifications of the triple paper where more than one couching are used, a gauge is required in order to place one layer exactly over the other, and for this purpose a very simple instrument has been contrived, being a frame with hinges, to allow it to be raised and thrown back when the felt is laid on, and yet always to fall down on the same spot on the felts; so that by placing the mould into the angle of this frame, it is sure always to be couched exactly in the same situation, and therefore to place the layers exactly over one another. This frame is further constructed, so that it will rise and fall on two fixed standards, according to the number of felts on the post. The construction of this instrument is so simple, that there can be no doubt of any person accustomed to paper-making comprehending it. The test of this triple paper as it may be termed, may be somewhat strengthened by leaving a margin of the interior coloured layer bare all round one of the faces of the note, which any paper-maker will know may be easily effected, by taking a smaller deckle for the last couching. By this means the fact of the colour in the interior appearing deeper when looked through than when looked at, is established; because the colour in this margin, though the same as that

that in the interior being superficial, appears paler when looked through ; that is to say, the effect of the superficially coloured margin is precisely the converse of the colour in the centre of the paper, though they are the same tints ; whence it is deduced, that if that which is superficial looks paler when held up to the light, that which looks darker so viewed must be in the interior ; and thus every doubt as to the test is removed by proofs existing in the note itself. I have already described a mode of improving the brilliancy of the water-mark in white bank-note paper, by a double layer of colourless pulp. Here therefore it may be observed, that this effect may be still heightened by giving a very faint tint in one of these layers. It is true this double paper would not afford all the advantages derivable from the tests of the interior colour, because all superficial colour may be laid upon ready made paper. Nevertheless, certain peculiarities in the mode of laying in this colour may be accomplished, which it would be extremely difficult for the forger to achieve, otherwise than by means of pulp in the original formation of the paper ; thus it may be laid on in a mottled state by a peculiar formation in the mould, and by the use of a thin copper strainer instead of wire in the sieves it may be laid on so as to produce a sort of shade to the transparent water-mark ; two descriptions of water-mark, one dark and the other transparent, being thus mixed by means of the two layers of paper, which would produce a most beautiful combined effect, to be only imitated in the original construction of the paper, and being perfectly indestructable, such paper would also be thinner than the triple paper. The paper thus made of different layers, whether double or triple, with the coloured layer or without it, is susceptible of another indelible description of mark in the interior, which cannot
be

be produced but in the first formation of the paper; thus after the first layer is couched it may be printed upon at the mill, either in colour or in black. I have thus printed various forms or figures, and even the promissory part itself of the note in the very heart of the paper before it was finished; that is to say, forming part of the first process at the mill. This printing, whatever it may be, may then be covered with the outer layer of very fine transparent pulp, either plain or with a transparent watermark, mixing and combining, if required, with the printed character in the interior. By this exterior covering it is obvious that this printing is not only protected from injury, but that it cannot be set off or rubbed down for the purposes of imitation. There is another improved manipulation as to the printing upon bank-notes, similar to the foregoing one, and productive of the same effects, namely, that the printing may in like manner be performed upon the paper in an unfinished and damped state, and previous to its being sized. This manipulation on the same principle as the last-mentioned process, will protect the printing from injury, and from being set off or rubbed down for the purposes of forgery, though not so completely as the last-mentioned mode, while it also improves the impression. And this also may be best performed by combining the operation of printing with the original formation of the paper at the mill, which necessarily places any improved effect thus attainable still further out of the reach of the forger; in short, it is evident that there is an infinite variety of these tests to be obtained by the different modifications of the principles herein stated, which it is not necessary further to describe.

In witness whereof, &c.

Specification

Specification of the Patent granted to EDGAR DOBBS, of the Borough of Southwark, Gentleman; for a Variety of Compositions for making a Water-proof Cement, Mortar, and Stucco, the same being also applicable as durable Colouring-washes for Buildings.

Dated August 2, 1810.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Edgar Dobbs do hereby declare that the principle of my invention consists, first, in making, by means of water, a proper admixture of lime, or its carbonates, with any one or more of the following substances, *viz.* clay, loam, mud, shale, road dirt or dust, soil, ochre, cheap metallic oxyds, ores, pyrites, blende, sand, stones, earths, ashes, and all such earthy bodies (lime and its carbonates as before excepted) as can be reduced to powder, and will not vitrify by the heat which they are subsequently to undergo. Secondly, in expelling the redundant water. Thirdly, in burning the mixture when in a concrete state. And, lastly, in reducing that mixture to powder. This powder is the composition for making the cement, mortar, stucco, and wash.

By carbonates of lime, I mean chalk, common limestones, marbles, oyster and other marine shells, earths, and earthy bodies, that will slack or fall into powder, either by contact of air or water, after being burnt. By ashes, I mean the unconsumed residue of coal or vegetable bodies after burning. The process is this: First, I reduce the lime, or its carbonate, to a fine state of division, the lime by slacking, and the carbonates by grinding them either with or without water, by the common methods used for grinding whiting, white lead, or flint, or by
some

some other method, equally effectual, until they are in such a state of disintegration, as, by subsequent agitation in water, will allow the finer particles to remain in suspension a sufficient time to pour off with the water from the grosser particles (which will have subsided, and may again be ground), and that the particles so poured off be about as fine as those of common whiting. Secondly, I reduce the other substance or substances with which I want to mix the lime or its carbonates to particles about the same fineness as those before described; the hard ones, or those which require grinding, are reduced either with or without water, and the finer parts, when mixed with water, poured off as before; or, if the selected substance or substances be sufficiently soft of themselves, omit the grinding, and simply diffuse them in water, by mixing and agitating them in it till the matter becomes of about a creamy consistency, and then wash off as before. Thirdly, I take certain portions of the washed lime, or its carbonate, according to the nature of the required composition, and of the other washed substance or substances, and mix and incorporate them well together in a vessel, or other receptacle fit for the purpose; or the incorporation may be made by adding to the bodies, in their natural state, a small quantity of water, and then grinding and tempering them till they become homogeneous and plastic. The diffused ingredients are then to rest, when the clear water is to be drawn off, and the remainder of it evaporated (as is also to be the case if they have been tempered), either by artificial heat, or by exposure to the atmosphere, till the mass becomes sufficiently stiff to be cut or moulded into pieces for burning. The burning may be performed in a common lime-kiln, stove, or furnace, or even without any apparatus of that nature, observing that the intensity and duration

duration of heat be sufficient to consume the combustible part of the ashes or fuel when contained in the mixture, and expel carbonic acid from carbonate of lime, without vitrifying any of the substances. The burnt pieces are afterwards to be reduced to powder, by grinding between horizontal stones, or by any other means usually employed for grinding dry substances, and then the composition is in a state fit for use. If the composition be intended for cement that will set in about ten or twenty minutes, and to be adopted to the general purposes of building, the proportions should be (each of the ingredients supposed to be in a dry state) about three parts by weight of chalk, or in lieu of chalk one and a half of lime, one part of such clay as is found in marshes on the banks of the Thames, or such as turn red by burning, and one part ash, such as is sold in London by the dealers in breeze. If it be required to set sooner, a greater proportion of lime or the carbonate must be taken, and if not so soon, a greater proportion of the other ingredients. If the composition be intended for a wash to resemble stone, it will be proper to use pipe-clay, or some soft earth free from iron or other colouring substances, that will not burn away and omit the coal-ashes altogether. If the ashes or any other combustible substance be omitted in any of the mixtures, either for the cement or the wash, then fuel must be employed in the burning, either by stratifying, as in lime-burning, or by any other convenient method at the discretion of the operator; but when a proper quantity of combustible substance enters into the compound no extraneous fuel is necessary. To use the composition as a cement or mortar, mix and temper it with water, and apply it while in a plastic state. To form and use the wash, add a sufficient

ficient quantity of water to the composition, as to make it capable of being applied with a brush as other water washes are, taking care that it be used soon after the addition of the water, as it will shortly slack or turn to a solid mass.

In witness whereof, &c.

On the ultimate Analysis of vegetable and animal Substances. By ANDREW URE, M. D. F. R. S.

From the PHILOSOPHICAL TRANSACTIONS of the
ROYAL SOCIETY of LONDON.

Concluded from Page 149.

WE now come to a class of bodies in which the hydrogen predominates over the oxygen. With regard to resin, I believe the quantity of its carbon to be somewhat under-rated in the table. Though three experiments were made on it, I now perceive that I had omitted to re-triturate and re-ignite; and the carbon of resin is very difficult of oxygenation. Its true composition is probably,

Carbon	8 atoms	....	6.0	....	75.00
Hydrogen	8	—	....	1.0	 12.50
Oxygen	1	—	....	1.0	 12.50
			8.0		100.00

A still more symmetric arrangement would be derived from

Carbon	8 atoms	....	6.0	....	73.9
Hydrogen	9	—	....	1.125	 13.8
Oxygen	1	—	....	1.000	 12.3
			8.125		100.0

This

This proportion corresponds to 8 atoms of olefiant gas and 1 atom of water ; and I think it is very possibly the true constitution of resin. Had the loss of weight suffered by the contents of the tube, during their ignition, been a few hundred parts of a grain more, the experimental result would have coincided with this theoretical view. Copal approaches to

Carbon	10 atoms	....	7.5	....	80.30
Hydrogen	7	—	....	0.875	 9.36
Oxygen	1	—	....	1.000	 10.34
			9.375		100.00

Lac may be nearly represented by

Carbon	6 atoms	....	4.5	....	64.3
Hydrogen	4	—	....	0.5	 28.5
Oxygen	2	—	....	2.0	 7.2
			7.0		100.0

or 2 atoms of olefiant gas + 1 atom carbonic oxyd ; that is equal weights of these two binary compounds ; for

$$2 \text{ atoms of olefiant gas} = 2 \times (0.75 + 0.125) = 1.75$$

$$1 \text{ atom carbonic oxyd} \dots\dots\dots = 1.75$$

Referred to volumes, we shall have lac to consist of equal parts of the two gases.

Resin of guaiac gives

Carbon	7 atoms	....	5.25	....	67.7
Hydrogen	4	—	....	0.50	 6.5
Oxygen	2	—	....	2.00	 25.8
			7.75		100.0

Although the experiments on amber were conducted carefully with re-trituration and re-ignition, no good

atomic configuration of it has occurred to me. It approaches to 10 carbon + 10 hydrogen, 10 hydrogen + 2 oxygen.

Wax is apparently composed of

Carbon	13 atoms	....	9.75	....	80.4
Hydrogen	11	—	....	1.375	, 11.3
Oxygen	1	—	....	1.000	 8.8
			12.125		100.0

or, in other words, of 11 atoms olefiant gas + 1 atom carbonic oxyd + 1 atom carbon. Had the experiment given a very little more hydrogen, we should have had wax as consisting of 12 atoms olefiant gas + 1 atom carbonic oxyd. This is possibly the true constitution.

Caoutchouc seems to consist of

Carbon	3 atoms	....	2.25	....	90
Hydrogen	2	—	....	0.25	 10
			2.50		100

Or it is a sesqui-carburetted hydrogen. The oxygen deducted from experiment is in such small quantity, as to leave a doubt whether it be essential to this body, or imbibed in minute quantity from the air during its consolidation.

Splent or slate coal, specific gravity 1.266, abstracting its incombustible ashes, approaches in constitution, to

Carbon	7 atoms	....	5.25	....	70.00
Hydrogen	3	—	....	0.375	 3.40
Oxygen	2	—	....	2.000	 26.6
			7.625		100.0

Cannel

Cannel coal from Woodhall, near Glasgow, specific gravity 1.228, resembles a compound of

Carbon	9 atoms	....	6.750	....	73.9
Hydrogen	3	—	....	0.375	 4.2
Oxygen	2	—	....	2.000	 21.9
			9.125		100.0

In both of these bodies there is an excess of carbon beyond the 3 atoms of olefiant gas and 2 of carbonic oxyd. The former coal has two extra atoms of carbon, and the latter four atoms. Hence this coal is found at the Glasgow gas-works to yield a very rich burning gas. I do not know whether the azote be essential to the constitution of this coal, or accidentally introduced from animal remains at the formation of the strata.

The elements of indigo may be grouped as follows :

Carbon	16 atoms	....	12.0	....	72.70
Hydrogen	6	—	....	0.75	 4.55
Oxygen	2	—	....	2.00	 12.15
Azote	1	—	....	1.75	 10.60
			16.50		100.00

or, in other terms, we shall have 1 atom cyanogen, 6 atoms olefiant gas, 2 atoms carbonic oxyd, and 6 atoms of carbon in excess.

I had intended to pursue, at considerable detail, my researches on this curious azotized product of vegetation; but the subject having been lately taken up, and ingeniously prosecuted by my pupil and friend, Mr. Walter Crum, I was induced to leave it in his hands. He announced to me the presence of hydrogen in indigo, before I had analized this substance myself; and drew my attention, particularly, to the fallacy occasioned by the hygrometric water of the peroxyd of copper. It is likely

likely that some slight modification may require to be made in my tabular proportion of the constituents, for I did not resume the subject of indigo after I had become most familiar with the manipulations.

Camphor is very nearly represented by

Carbon	10 atoms	....	7.5	....	78.02
Hydrogen	9 —	....	1.125	....	11.58
Oxygen	1 —	....	1.0	....	10.40
			9.625		100.00

or 9 atoms olefiant gas + 1 atom carbonic oxyd. Naphthaline is, in my opinion, a solid bi-carburet of hydrogen, consisting of

Carbon	2 atoms	....	1.5	....	92.9
Hydrogen	1 —	....	0.125	....	7.1
			1.625		100.0

It is very difficult, even by the best regulated ignition, to resolve the whole carbon of this very volatile body into carbonic acid; hence, the carbon may come to be underated in the result. Naphthaline is obtained during the rectification of the petroleum of the coal-gas works. It is found encrusting the pipes in the form of a greyish crystalline mass; and when purified by a second sublimation at the temperature of about 220°, it forms beautiful thin plates, white and glistenig. It has a powerful petroleum odour. With brine of the specific gravity 1.048, these plates, when once thoroughly wetted (which is difficult to effect) remain in equilibrium; that is, float in any part of the liquid. That number, therefore, represents the specific gravity of naphthaline. It is insoluble in water, but very soluble in ether, and moderately so in alcohol. With iodine it fuses, at a gentle heat, into a brown liquid, forming as it cools a solid resembling

bling plumbago, which dissolves readily in alcohol, and is thrown down by water. Naphthaline is soluble in oils. In water heated to 168° F. it fuses, and remains like oil at the bottom of the liquid; but when stirred it rises, and spreads on the top in little oily patches. At 180° it rises spontaneously from the bottom in oily globules, which, as the temperature is raised, dissipate in the air, undergoing motions similar to those of camphor floating on water.

Spermaceti oil is constituted apparently of

Carbon	10 atoms	.. .	7.5	....	78.0
Hydrogen	9	—	....	1.125	 11.8
Oxygen	1	—	....	1.0	 10.2
				9.625	100.0

or, in other words, of 9 atoms olefiant gas + 1 atom carbonic oxyd. The experimental proportion is, however, more nearly,

Carbon	10 atoms	....	7.5	....	79.0
Hydrogen	8	—	....	1.0	 10.5
Oxygen	1	—	....	1.0	 10.5
				9.5	100.0

There is here an atom of carbon in excess*.

Common oil of turpentine, specific gravity 0.888, comes very closely to the following arrangement :

Carbon	14 atoms	....	10.5	....	82.35
Hydrogen	10	—	....	1.25	 9.80
Oxygen	1	—	....	1.00	 7.85
				12.75	100.00

Oil of turpentine, purified with alcohol by Dr. Nimmo's

* This is probably the truer view. The former would make it coincide with camphor.

method,

method, seems to approach to the constitution of naphtha, or of a mere carburet of hydrogen. Its specific gravity is 0.878. But as from the mode of preparing it a minute portion of alcohol may remain in it, I do not think it necessary to investigate its atomical structure.

Naphtha, specific gravity 0.857, obtained by distillation from petroleum, is very nearly represented by,

Carbon	22 atoms	....	16.50	....	82.5
Hydrogen	20	—	....	2.50	 12.5
Oxygen	1	—	....	1.00	... 5.0
			20.00		100.0

It therefore consists of 20 atoms olefiant gas, 1 atom carbonic oxyd, and 1 atom of carbon held in solution.

Castor-oil is an interesting unctuous body, from its great solubility in alcohol. It consists nearly of

Carbon	7 atoms	....	5.25	....	75.00
Hydrogen	6	—	....	0.75	 10.70
Oxygen	1	—	....	1.00	 14.30
			7.00		100.00

It is composed therefore of 6 atoms olefiant gas + 1 atom carbonic oxyd; or in volumes of 3 olefiant gas + 1 carbonic oxyd.

Alcohol, specific gravity 0.812, is composed very nearly of

Carbon	3 atoms	....	2.250	....	46.15
Hydrogen	5	—	....	0.625	 12.82
Oxygen	2	—	....	2.000	 40.03
			4.875		100.00

or, of 3 atoms olefiant gas = 2.625.

2 — water = 2.25.

And in volumes 3 olefiant gas = $.9722 \times 3 = 2.9166$

4 aqueous vapour = $.625 \times 4 = 2.500$

Thus

Thus alcohol of 0.812, by the above analysis, which I believe merits confidence, from the care and consistency of the experiments, differs from M. Gay Lussac's view of absolute alcohol, deduced from M. Th. de Saussure's experiments, in containing an additional volume of aqueous vapour. At the specific gravity .814 alcohol would have exactly this atomic constitution. If the condensation be equal to the whole 3 volumes of olefiant gas, that is, if the 7 volumes of constituent gases become 4 of alcohol vapour, we shall have its specific gravity at this strength = 1.3722; the additional volume of aqueous vapour producing necessarily this abatement in the density.

We have already considered sulphuric ether.

The next four bodies which occur in the table are of fibrous texture, and are chemically characterised by an excess of oxygen beyond the hydrogen equivalent.

Fibres of the bleached threads of the silk-worm were subjected to analysis. Their composition is apparently,

Carbon	10 atoms	....	7.5	....	50.8
Hydrogen	4 —	....	0.5	....	3.4
Oxygen	5 —	....	5.0	....	34.0
Azote	1 —	....	1.75	....	11.8
			14.75		100.0

or, 4 of olefiant gas, 5 of carbonic oxyd, and 1 of nitrous oxyd; or, of 1 atom prussic acid, 3 atoms olefiant gas, and 5 atoms carbonic oxyd.

Cotton fibres, unbleached, seem to consist of

Carbon	11 atoms	....	8.25	....	42.85
Hydrogen	8 —	....	1.00	....	5.80
Oxygen	10 —	....	10.00	....	51.85
			19.25		100.00

Flax,

Flax, by Lee's patent process, consists of

Carbon	7 atoms	....	5.25	....	44.25
Hydrogen	5	—	....	0.625	 5.25
Oxygen	6	—	....	6.000	 50.50
			11.875		100.00

It contains more carbon, and is therefore probably stronger than common flax, prepared by a putrefactive maceration. This seems composed of

Carbon	1 atom	....	0.75	....	40.0
Hydrogen	1	—	....	0.125	 6.6
Oxygen	1	—	....	1.000	 53.4
			1.875		100.0

But this is the theoretical representation of sugar by M. Gay Lussac and Dr. Prout; and, hence, these chemists would readily explain, how linen rags may pass into the form of sugar, by the action of sulphuric acid.

Wool approximates to

Carbon	10 atoms	....	7.5	....	55.0
Hydrogen	3	—	....	0.375	 2.8
Oxygen	4	—	....	4.000	 29.4
Azote	1	—	....	1.750	 12.8
			13.625		100.0

Cochineal seems to be made up of

Carbon	15 atoms	....	11.250	....	50.20
Hydrogen	11	—	....	1.375	 6.15
Oxygen	8	—	....	8.000	 35.85
Azote	1	—	....	1.750	 7.80
			22.375		100.00

Cantharides

Cantharides approximate to

Carbon	11 atoms	....	9.75	....	49.4
Hydrogen	10 —	....	1.25	....	6.3
Oxygen	7 —	....	7.00	....	35.4
Azote	1 —	....	1.75	....	8.9
			19.75		100.0

My result with urea differs so considerably in the proportion of azote, from that of Dr. Prout and M. Berard, that I am disposed to doubt of the accuracy of my experiments, though they were made with the utmost care, and were most consistent in the repetition. I could perceive no smell whatever of nitrous gas in the gaseous products, which were made to traverse a column of copper filings 3 inches long, in a state of ignition. I shall renew the inquiry on urea, and employ the lowest temperature compatible with the formation of carbonic acid.

The prime equivalent of benzoic acid crystals, I find by saturation with water of ammonia, to be 14.5; and it consists apparently of

Carbon	13 atoms	....	9.75	....	67.24
Hydrogen	6 —	....	0.75	....	5.16
Oxygen	4 —	....	4.00	....	27.60
			14.50		100.00

Of crystalline citric acid, the prime equivalent is 8.375 by my experiments; and it consists probably of

Carbon	4 atoms	....	3.000	....	35.8
Hydrogen	3 —	....	0.375	....	4.5
Oxygen	5 —	....	5.000	....	59.7
			8.375		100.0

or, of 4 atoms carbon, 3 water, and 2 oxygen. Two of these atoms of water are separated, when citric acid is combined with oxyd of lead in what is called the dry citrate. Hence, the acid atom is in this case 6.125.

The prime equivalent of crystalline tartaric acid is 9.25 by my results; and it seems made up of

Carbon	4 atoms	....	3.0	....	32.43
Hydrogen	2 —	....	0.25	....	2.70
Oxygen	6 —	....	6.00	....	64.87
			9.25		100.00
or, of Carbon	4 atoms	....	3.0	....	32.43
Oxygen	4 —	....	4.0	....	43.24
Water	2 —	....	2.25	....	24.33
			9.25		100.00

From my experiments I have been led to conclude, that into dry tartrate of lead these two atoms of water *do* enter as a constituent; and, hence, that the crystals of tartaric acid are as dry as is compatible with its constitution.

Oxalic acid crystals have 7.875 for their prime equivalent; and are composed of

Carbon	2 atoms	....	1.500	....	19.04
Hydrogen	3 —	....	0.375	....	4.80
Oxygen	6 —	....	6.000	....	76.16
			7.875		100.00
or, of 2 atoms Carbon		....	1.5	....	19.14
3 — Oxygen		....	3.0	....	40.72
3 — Water		....	3.375	....	40.14
			7.875		100.00

Into the dry oxalate of lead these 3 atoms of water *do not* enter. Hence, I find the dry acid to be composed of

Carbon	2 atoms	....	1.5	....	33.33
Oxygen	3 —	....	3.0	....	66.66
			4.5		100.00

or, of 1 atom carbonic acid + 1 atom carbonic oxyd, as was first suggested, I believe, by Dobereiner. Crystallised

lised oxalate of ammonia consists of 1 atom acid, 1 atom ammonia, and 2 atoms water = 8.875. By a gentle heat 1 atom of water may be separated; and an oxalate of ammonia, as dry as is compatible with its neutrality, remains.

I have analysed, by the peroxyde of copper, the citrate, tartrate, and oxalate of lead; and on comparing the results thus obtained, with those derived from the analysis of the crystalline acids, I have come to the above determinations.

Ferroproussic acid, the ferrocyanic acid of the French chemists, has proved, hitherto, a stumbling block to me, in reducing the results of my experiments to the atomic theory. I have subjected it to very numerous trials in many states of combination, and have sought, with great pains, to accommodate the results to the doctrine of prime equivalents; but hitherto without success. The following facts, however, may perhaps be deemed of some consequence.

In the first place, the prime equivalent of the crystallised ferroproussiate of potash is 13.125, compared to oxyd of lead 14, and to nitrate of the same metal 20.75; that is, 13.125 of the former salt neutralise 20.75 of the latter. In the second place, 14 parts of oxyd of lead yield 21 parts of dry ferroproussiate of lead; or the atomic weight of dry ferroproussic acid is 7.

The mean of my analyses of ferroproussiate of lead, gives the relation of the constituents of the acid, as marked in the table. These proportions, reduced to the atomic weight 7, afford

Carbon	2.5774
Azote	2.4703
Ferrous matter	1.9523
	7.0000

Were

Were we to suppose the prime equivalent of the ferroprussic acid 7.5 instead of 7; and were we, farther, to suppose that the carbon in the above result should be $2.25 = 3$ atoms, and the azote $= 3.5$, or two atoms, then we might conceive an atom of dry ferroprussic acid to be made up of

Carbon	3 atoms	2.25
Azote	2 —	3.50
Iron	1 —	1.75
		7.50

But experiment does not permit me to adopt this theoretical representation.

The best mode that has occurred to me for analysing ferroprussiate of potash, is to convert it, by the equivalent quantity of nitrate of lead, into the ferroprussiate of this metal; then to separate the nitrate of potash by filtration; and, after evaporation, to determine its weight. In this way, 13.125 grains of crystallised ferroprussiate of potash afford 12.33 grains of nitre, which contain 5.8 of potash *. By heating nitric acid in excess on 21 grains of ferroprussiate of lead, I obtained 2.625 grains of peroxyd of iron, equivalent to 1.8375 of the metal. Hence I infer, that the iron in the ferroprussiate of lead is in the metallic state; for the joint weights of the carbon and azote contained in 7 grains of the dry acid is 5.0477; and the difference, 1.9523, approaches too closely to the above quantity, 1.8375, for us to suppose the metal to be in the state of protoxyd. In fact, $2.625 \text{ parts of peroxyd} \times 0.9 = 2.3625$ of protoxyd, is a quantity much beyond what experiment shows to be present.

* By careful desiccation, 1.69 grains of water may be separated from 13.125 grains of salt.

Description of an improved Ship's Compass.
By Mr. R. PIKE LITTLEWORT, Lieut. R. N.

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the ENCOURAGEMENT of ARTS, MANUFACTURES, and COMMERCE.

The large Silver Medal was given to Mr. LITTLEWORT for this Communication.

THE kinds of compasses used on ship-board, are the binnacle or steering compass, the hanging compass, suspended in the cabin to enable the captain to ascertain whether the steersman is attentive to his duty (and hence often called the tell-tale), the amplitude compass, and the azimuth compass; this latter, being for the purpose of observing the sun or other heavenly body, and thence obtaining the variation of the needle, is only occasionally employed.

In merchant ships, except those of the largest class, the azimuth compass is generally dispensed with, because this instrument is costly, requires for its use a greater knowledge of navigation than masters of merchant ships are usually possessed of, and, although of great utility, is not an article of absolute indispensable necessity.

The object of Lieut. Littlewort is to render the hanging compass convertible into an azimuth compass, and thus to enable masters of ships to obtain at an easy cost an instrument, the utility of which is unquestioned, and the employment of which will contribute at the same time to the safety of the ship, and to their own improvement in the higher branches of navigation.

Lieut. Littlewort's compass, like the better kinds of common compasses, has two cards, one light and very moveable, for fine weather; and another heavier, for use when the vessel has much motion: this latter Lieut. Littlewort

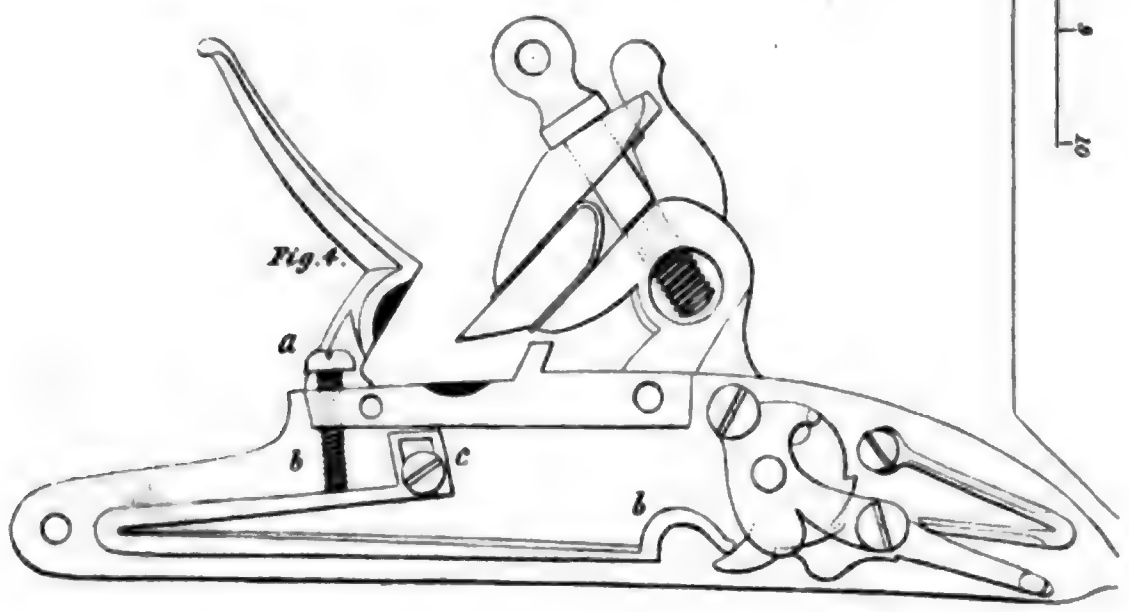
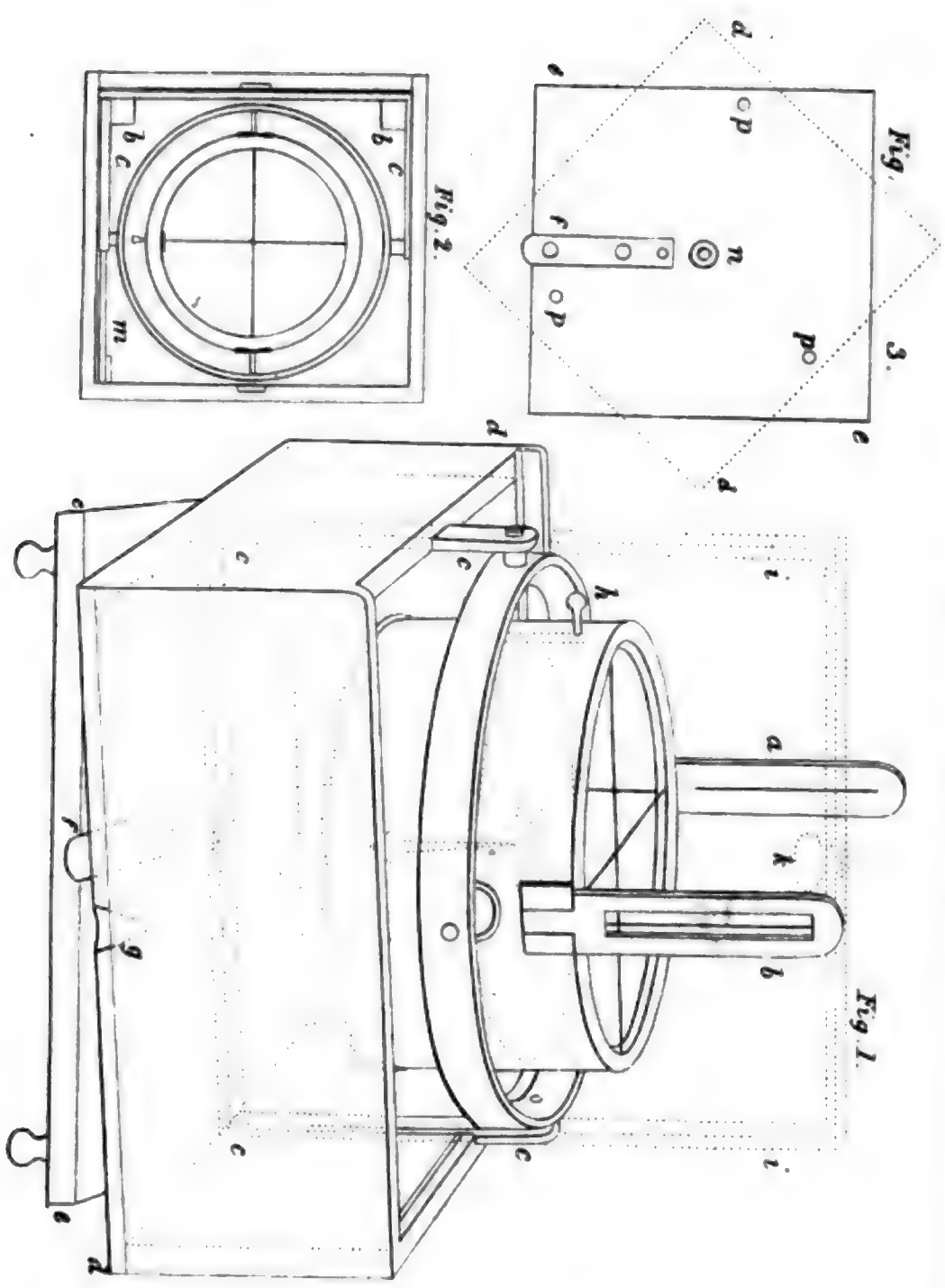
tlewort has weighed by fixing on its circumference an accurately graduated silver circle; and this it is which is employed when the compass is used for azimuths. The handle by which the compass is suspended to the roof of the cabin, is capable of being inverted and of supporting the compass by sliding in a groove made in a box, which box is capable of motion, on a central pin fixed in the board on which the box stands; moveable sights and a stop are also annexed, which enables it to act when required as an azimuth compass.

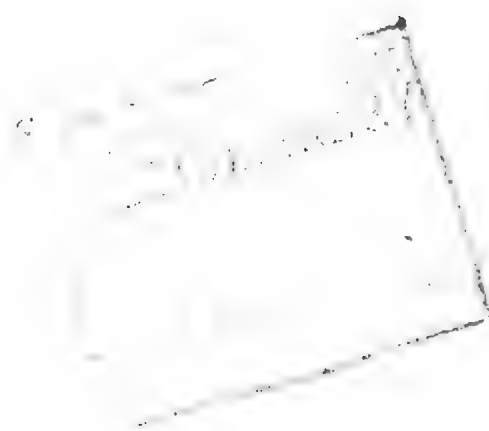
The parts will be better understood by reference to the engraving.

Fig. 1 (Plate XI.) shows the compass, one quarter the real size, with the sights *a* and *b* put on, and fixed up as an azimuth compass, by means of the inverted handle *c c*, in the box *d d*; this box is attached to the board *e e* by a pin in its centre, on which it turns; *f* a spring pin, which snaps into a hole at *g*, to fix the box when required; *h* a stop to press against the card, and check its vibrations. When it is used as a hanging compass, the arms or frame *c c*, are drawn out of their grooves in the box and turned up, as the dotted lines *i i*, and fixed to the ceiling by a screw *k*; the sights *a* and *b* being then removed, the card is seen through the glass bottom. When used as a steering compass, it is put into the box as if packed up, shown in Fig. 2, one-eighth of the real size, where the frame *c c* is held by two blocks of wood *b b*, the box being a little longer that way, to receive the frame without a groove; *m*, the place where the sights *a* and *b* are laid in the box.

Fig. 3 shows the board *e e*, with the spring *f*; *n* the centre on which the box turns; *p, p, p*, three studs to give a better bearing for the box *d d*, and to raise it high enough to clear the spring pin *f*, when that spring is pressed down.

Description





*Description of a regulating Screw, for the Main-spring of
Muskets and other Fire-arms.*

By Mr. EZEKIEL BAKER, of Whitechapel-road.

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the ENCOURAGEMENT of ARTS, MANUFACTURES, and COMMERCE.

*The Silver Vulcan Medal was voted to Mr. BAKER for
this Communication.*

THE following explanation of this invention is necessary for clearly comprehending the advantages to be derived from its adoption.

It is well known that the main-spring of all locks loses its strength either from wear or from the effects of climate, as also that the flints become thick from use, either of which is of itself sufficient to cause the lock to miss fire. This was, perhaps, more particularly exemplified by the volunteer regiments, on field-days, when embodied during the late war, and the fact has been corroborated by many veteran soldiers, as having occurred too frequently on the field of battle.

Now, my invention will remove all this, and may be easily effected by the soldier with the common turn-screw, which, it is well known, he invariably carries to put in his flint, &c. It consists of a regulating screw-pin, which is placed behind the hammer, through the solid piece of the plate. This pin, when screwed down, acts upon the short side of the main-spring, by forcing which its strength is increased, and more fire is consequently drawn from the hammer; so that, in either of the instances alluded to, fire is produced when it would otherwise

otherwise fail. On the other hand, when a new flint is introduced, the power of the main-spring may be lessened by turning the screw-spring backwards; by which means the flint is prevented from breaking, as frequently happens when it is put into a lock upon the present construction.

Having alluded to the more important consideration of rendering musket-locks perfect on the field of battle, the same will apply to gentlemen sportsmen, and will prevent the vexation and disappointment that too often occurs from locks missing fire, when an experienced shot would otherwise make sure of bagging his game. I have for many months experienced its advantages, and have the satisfaction of testimonials from some of the most experienced game-keepers, whose whole lives have been devoted to the sports of the field. Those of his Grace the Duke of Bedford, Lord Petre, and Sir Thomas Leonard, would of themselves be sufficient, but I have others from private individuals, equally flattering to my improvement.

I should remark, that to all new locks the invention can be applied *without any additional expense*; but to old locks, in most instances, it will be necessary to have a new main-spring, as the stud which holds it steady on the plate is usually placed on the middle of the short side of the spring, and consequently the regulating-screw, applied to these, may chance to break itself, or break the main-spring; whereas, in a new lock, I place the stud on the bend of the spring, which enables it to play at pleasure, without fear of injuring the one or the other. I also make the hole in the eye of the spring oblong, so as to enable it to play more easily up or down, as occasion may require, than the round hole admits.

This invention may be applied with equal effect to the
locks

locks of doors, and spring bolts of every description, when from weakness or any other cause, the springs lose their power; and the great advantage is, that my improvement may be adopted at a very trifling expense.

Having explained the simplicity with which my invention may be applied, I will not take up more of your valuable time; but shall be happy to wait on the Society at their convenience, and furnish every information which may be required for a clearer elucidation than I may be able to convey on paper.

P. S.—I am well aware, that the hammer springs of saddle pistol and gun-locks, have been long since made with a similar provision to the above; but, I believe, its application to the main-springs, where it is of so much more importance, has never been made by any one previous to my doing it.

REFERENCE TO THE ENGRAVING.

Fig. 4 (Plate XI.) represents the inside of a lock of the usual construction, with the addition of an adjusting screw *a*; this screw presses against the main-spring *b b*, and when driven forwards greatly increases its power, so that when a flint is getting blunt, the power of the spring may be so increased as to secure its giving fire, and when a new flint is put in, it may be preserved by releasing the main-spring, so as to act with no more power than is just requisite to give fire. The hole in the tail of the spring *b*, is elongated to slide under the screw head *c*, when the adjusting screw *a* is moved.

Description of a Life-Boat, built by Subscription at Ipswich, and stationed at Languard Fort; from a Design executed by Mr. RICHARD HALL GOWER, Author of several Works on Seamanship and Marine Affairs.

With an Engraving.

From the PHILOSOPHICAL MAGAZINE and JOURNAL.

THIS life-boat is of very light structure, being clench-built, with half-inch oak plank, and timbered with young ash wood, three-fourths of an inch square, bent to the curvature of the boat. The form of the boat is alike at each end, with a long flat floor, and with a flaring out and unusually projecting head and stern, to meet and lift over the sea. She is decked to four and a half feet from each end, which is covered with stout canvass, and she is steered by a long oar over the stern; the commanding power of which, when properly used, will oblige the bow to face the head-sea, or keep the stern to the following sea; an end-on position with the running sea being essentially necessary to the preservation of the boat, particularly on the occasion of passing her off from and returning through a heavy surf to the shore. These are times of absolute danger; and in case of being filled with water by the staving-in of the bottom, or from the sea heaving too heavily on board her, she is preserved from sinking by the floating capacity of fourteen light cases, which are shaped to meet their several places in the boat beneath the rowing thwarts; viz. a tier amidships, and a tier on each side. These cases are covered with light sheet-copper, about twelve ounces to the square foot, and so carefully soldered as to exclude the entrance of the water. There are five cases in each side tier, and four

four equal cases in the middle tier. Each side tier contains eleven and a half cubic feet, and the midships tier twenty-seven, making fifty cubic feet in cases. Besides this kind of floating capacity, there are eleven feet of cork contained beneath the level of the thwarts at the extreme ends of the vessel. The cases upon an average weigh eight pounds to the cubic foot; and admitting that a cubic foot of salt-water weighs sixty-four and a half pounds, each cubic foot of the cases will, on the average, sustain fifty-six and a half pounds; and if the cork will sustain fifty pounds, the whole floating capacity will bear up three thousand three hundred and seventy-five pounds, or twenty-three men and forty pounds, allowing each man to weigh one hundred and forty-five pounds.

The boat is rigged in the simplest manner, with two snug foul-weather sprit-sails, which take up very little room, and are readily stowed away clear of the oars on each side of the boat, being, moreover, a kind of sail the management of which is well understood by the generality of seamen. Within the boat are two delivering copper tubes, of three inches diameter. These pass through her bottom, and are secured by flanges on the outside, and rise up within board to the level which the water takes when it is allowed to flow into the vessel with her crew on board. These tubes will deliver water by self-action whenever its level shall be above their tops, and above the level of the water without the boat, and are intended to aid the bailers when their best exertions cannot deliver the sea that is thrown on board. At such times it will be proper to pull out the four plugs in the bottom of the boat, so that the superabundant water above the level within board, when the boat is resting upon her floats, may pass off by this means, as well as through

through the tubes, and thereby may probably take from the necessity of bailing altogether. The same sized plug-holes will equally deliver with the tubes; but the tubes are always open to meet the occasion, while the plugs may be neglected to be withdrawn.

The general exterior of the boat under canvass, with the steering oar to its position on its pivot at the stern, is represented by Fig. 5. (Plate XI.) From the rounding form of her body she may be considered as bearing a resemblance to some Indian canoe, with the attachment of a keel. In this figure are shown, by dashed lines, the heights of the thwarts and platform, and the several spaces for the stowage of her materials. The floating capacity, in cases, is contained throughout the length beneath the thwarts lettered A and A; and the spaces B and B at the extremities contain the cork. C and C are empty spaces beneath the deck for the stowage of such articles as require to be kept dry, as clothing and provisions. D and D are bailing places, having two plug-holes in each of one inch and half diameter, with a trap-door to cover over them, to render the platform complete when they are not required to be open. The platform between the thwarts A and A is made to lift, so that the space beneath it may be applied to the reception of such quantity of small tow-line as it may be considered necessary to have on board, in cases of emergency; and the cable and sern-fast are coiled away on the platform, clear of the bailing places, at E and E. F is a crutch to receive the helmsman's thighs just above the knees, and enables him to stand with firmness on his platform to effect the steerage duty. This is better understood by the bird's-eye view of the thing in Fig. 6 at B.

Fig. 6 is a whole-breadth plan of the interior of the vessel, with the position of the thwarts, and of the cases
of

of floating capacity on each side and amidships, throughout the length, between and beneath the thwarts A and A ; the cases being marked with the letter C. D D and D D are strong cant-pieces or breast-beams across the boat, which limit the extent of each deck ; and by rising up about two inches above, they turn all the water over the side, which may be thrown upon the deck, and would otherwise come into the body of the boat. Through holes at the ends of these cant-pieces are wrought four rope-rings or grummets, for the purpose of receiving oars, to assist the steerage, or ropes on any particular occasion, and the squares by these grummets show the places of four timber-heads : two more also are placed by the foremast ; these are convenient to fasten the cable to, and the side ones for head and stern-fasts when alongside a vessel. All the timber-heads are about ten inches above the gunnel, and are secured by stepping their keels into the thwart beneath, and then bolting them to the breast-beams ; and they have a fore-and-aft pin of five-eighths iron passed through their heads, to prevent the turn of a rope from flying off. The darkest shading represents the space left in the boat as foot-room for the rowers clear of the floating capacity.

About eight inches below the gunnel, on each side of the boat, is fixed a rack or general handle E E and E E, whereby a number of men may at once take hold of the boat with good effect, and remove her from one place to another, or launch her with readiness into the water. This rack takes the sheer of the boat, and about an inch above it is a cork fender (G G, Fig. 5) which runs with the sheer of the boat. This fender is four inches deep by two and a half wide, so as to extend beyond the rack as a safe-guard to it, and to the boat in case of a blow. It will also in some measure secure the stability of the
boat

boat on the occasion of a lurch or roll ; but independently of this circumstance, and of the general form of the boat, the stability is further insured by the aid of an iron keel of two hundred and twenty pounds weight. The racks are fitted immediately beneath one of the boat's lands, or projecting edges of her planks ; and the cork fenders, which are covered with stout canvass, are secured to their places by copper staples, which are drawn tight to the fender by screw-nuts upon their ends within the boat, being placed at the distance of about fourteen inches from each other. The position of the rack and fender is better shown at E and E in the transverse section of the boat, Fig. 9.

The copper cases are secured from injury by an external casing of half-inch fir, ledged together into panels, and secured about them without any nailing. The thwarts also are so dovetailed and hooked to the shelf, or rising of the boat, as to effect the tying of her sides together without the application of knees. This manner of fixing the thwarts, and stationing the pannelling, is done for the convenience of getting at the floating capacity with readiness, for examination, without the assistance of a carpenter ; and the mode of doing it is rendered clear by the assistance of Fig. 7, which is a midship section of the boat to a half-inch scale.

The lighter shading in this figure, lettered A, A, A, represents the three tier of coppered cases ; the dark margin on their tops, and about their sides, being a section of the pannelling. The middle tier of cases, with its pannelling, rests in two grooved sleepers or cants, B and B, which are firmly secured fore and aft to the bottom of the boat by nails driven from the outside, and well clenched within. The lower edges also of the side tier of cases, with their pannelling, are secured by similar
cants

cants C and C, which curve up, fore and aft, along each side; and the upper edges of the pannelling are secured from falling out by flat-headed five-eighths bolts, two inches and a half long, which are driven tight through holes in the thwarts, as represented at D and D. The thwarts are dove-tailed into the boat's rising or shelf, E and E, and are further secured by copper hooks or clamps being attached beneath the end of the thwarts, which hook outside the rising, as shown by the dark-lined representation of the thing at E and E. As the thwarts are pressed upwards, in a material degree, by the floating capacity, when the boat is filled with water, their ends are kept from rising by chocks of wood between them and the gunnel; and the middle parts of the thwarts are kept down by iron hooks, F and F, which are secured by side-bolts into the cants B and B, and hook into eye-bolts beneath the thwarts, and are secured to their places by short bolts, driven through the thwarts at the back of each hook, similar to the bolts D and D, which secure the upper edges of the pannelling. A side view of one of these hooks is given by Fig. 8. The platform G G and G G, which are made in two lengths of planks, so as to be readily lifted up, rests on ledges G G and G G, which are nailed to the pannelling, and are secured from floating, when water is in the boat, by copper sliding-bolts, which shoot into holes in the ledges of the pannelling.

Fig. 9 is a section of the boat, showing the delivering tubes A A, with the casing or well around them for their security; also the mast, as fixed in its step between them. On the outside of this section are several horizontal lines, which mark the boat's draught of water in her various states. The lines B and B show the draught with the crew and her materials on board. The lines C and C represent

present the draught with the same persons on board, but with the plugs out, and the water inside the vessel being on a level with the water without; the vessel at this time being rested upon, or entirely borne up from sinking deeper by the floating capacity within the boat. The lines D and D show the draught under similar circumstances, but with seven extra hands on board.

Fig. 10 is a ground-plan of the mast-step, which is fayed close down across the bottom of the boat, and there secured. The circles represent the holes through it, which receive the tubes and give them a firm and steady security. The small square between them is the mortice-hole, which receives the mast; the dark margin around is a section of the well, and the dashed oblong is the extent of the step across the bottom of the boat.

Fig. 11 represents one quarter of the vessel, and comprehends a sufficiency of lines to exemplify her form to a builder. The general dimensions of the boat are thirty-one feet from rabbet to rabbet, at the stem and stern, and six feet beam from outside to outside; the height from the keel-seam amidships being two feet ten inches, and four feet two inches at the bow and stern.

This life-boat was launched on the 4th of April 1821, in the presence of a large concourse of spectators; when the following experiments were confided to the able management of Mr. Benjamin Hamblin, master of the Stevens, whose readiness to oblige every one with a view of the vessel, in her several states, gave pleasure to all.

In the first instance, the boat was rowed down the river, nearly to the ballast-wharf, and up again to the bridge, at Ipswich, by six able young seamen, in excellent style, which fairly set forth her ability as a row-boat. In this state, with her crew of seven men, and one extra hand on board, her gunnel amidships was
twenty

twenty inches out of the water, as represented by the line B B, Fig. 9.

Secondly, she was exhibited as a life-boat, supposed to be filled by shipping more water than bailing would overcome; till, with the plugs out, or as if a plank was stove in the bottom, the water within and without board was upon a level. In this water-logged state she was almost as manageable, and rowed with nearly the same facility, as when empty; the gunnel amidships being fourteen inches out of the water, as represented by the line C C, Fig. 9.

Thirdly, she was exhibited in the same state, but with seven extra men on board, which is more than is likely to be ship-wrecked in any vessel from this port: yet still she continued so perfectly manageable, that Mr. Hamblin remarked, he should have full confidence, while in this predicament, with sixteen men on board in a sea-way. During this experiment the gunnel amidships was eleven and a half inches out of the water, as represented by the line D D, Fig. 9.

Fourthly, in the same state, but with eight men only on board, she was rowed down the river and back with two men constantly bailing into the vessel, without causing any material increase of the water within-board; for the water within-board must of necessity be above the level of the water without, before it will deliver itself by self-action through the plug-holes in the bottom, and down the three-inch pipes; and when at a *certain* height, it delivered itself so fast through these apertures, that the bailers were incapable of raising it higher. Men were now put on board her, merely to see how many were enough to put all the floating capacity within the boat beneath the water. This was effected by increasing the number to twenty-five, and is fairly corroborative of

the calculation which makes the floating capacity capable of sustaining twenty-three men and forty pounds, particularly when it is considered that a portion of their weight was in effect taken off by the immersion of their legs in water, and that the men employed might not average one hundred and forty-five pounds.

It must be recollected that the second, third, and fourth experiments are representations of extreme circumstances, and such as can only take place on the occasion of a plank being stove in the bottom; or when, from improper steerage, or on getting into broken water, more sea is shipped than the bailers can overcome, at which time it will be proper to take out the plugs in the bottom of the boat. A boat, however, of her build, if properly steered, with her head to the sea, or with her stern to the following sea, is not at any time likely to ship more water than a single bailer will overcome; and then, with her plugs in, she will continue a dry boat, and alive to her duty, with more men on board than she could conveniently stow.

Remarks—In the generality of life-boats the great body of the floating capacity is effected by fixing cork round the outside of the vessel; but as these external projections, when doing their duty by immersion, are a material hindrance to the progress of the vessel through the water, the designer of the present plan has placed the floating capacity within-board. A life-boat, to be perfect, should not only have the property of floating herself and all on board, when filled with water; but she also should possess the capability of being made to obtain the position of the unfortunate who are to be saved. The designer has seen several of the most approved life-boats; but all have appeared to him as too large and heavy for the purpose, and materially wanting the essential

tial property of locomotion ; and to be possessed of floatation without celerity of motion, is to render the whole abortive.

Cork is usually employed in life-boats as a floating capacity, and is highly valuable from not being liable to accident ; but the best of cork, when closely packed, has more specific gravity, and will take up far more room in the vessel, than the coppered cases here employed to effect the purpose. Cork will also contain a considerable body of water hanging about it for a length of time, in its inclosed state, which must rot the vessel ; whereas the coppered cases, from becoming presently dry, produce no such evil effect.

This life-boat is not provided with a rudder ; indeed the form will scarcely admit an effective rudder to be attached to her, and for a life-boat, on her proper duty in heavy weather, a rudder is not only useless, but might become dangerous. A rudder can be of no service to any vessel without way through the water ; and the small way obtained on pulling against a high head-sea, is not enough to affect the steerage, when a commanding helm is absolutely necessary to keep the boat's head to the sea. A rudder, therefore, can be no value to a life-boat ; but, on the contrary, it may even prove the cause of her destruction ; for instance, on the occasion of passing to the land to beach the boat through a heavy following sea, breaking with violence into a high surf as it reaches the shore. At such time, by the surf passing the boat with impetuosity, the rudder will be forced across the stern, and the people at the same instant being in all likelihood, thrown from their oars, the boat, of necessity, under the influence of the rudder alone, will be cast broadside to the sea, and swamped. The commanding oar, therefore, at the stern is the only safe-guard on the occasion, and indeed

indeed every other; for, even when rowing or sailing in the trough of a high sea, with good way through the water, if a high curling-headed sea is observed to approach the beam, with a prospect of heaving on board, the power of the oar will at once throw the vessel's bow to the sea and disarm its vengeance, which the less quick power of the rudder would have been incapable of effecting.

In most life-boats the oars are fixed to be rowed through rope-rings or grummetts, over a single iron thole like the steerage oar of the present boat, whereby, if quitted by its rower, it is secured to its place.

This plan of rowing by a single thole is much practised by the Spaniards, Portuguese, and others. As few English seamen, however, are accustomed to the mode, and as the life-boat in question was not to have a fixed crew practised to the art, but to depend on such chance crew of volunteer seamen as might be on the spot when the boat was required, it was thought preferable to continue the double English thole, which our seamen are accustomed to, and which allows them to feather their oar with readiness, an art of material moment when progress is to be made against a strong wind and head-sea. These tholes are fitted to the life-boat after the manner practised in the Southern whale fishery. Their lower ends are prepared with a hole; and each pair being set in their holes in the gunnel, they are united by having the ends of a piece of small line spliced into the holes, with a spare thole on its bight, as shewn by Fig. 12. This line should be about eighteen inches long, or sufficiently long to allow of the tholes being taken out, and hung within-board, when the boat is alongside any vessel, whereby they are prevented from being lost or broken; and if any
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are broken while rowing, spare tholes are at hand to supply their places.

It was an object of consideration, not to take from the value of this small life-boat by fitting her out with stores of unnecessary weight and magnitude, as the more she was encumbered and loaded, the less would she be equal to the duties of a life-boat. In consequence, whale-line was adjudged to be the kind of rope best suited to all the purposes of the boat, for cable as well as warp-line. An experienced commander in the Southern whale-fishery informed the author, that having harpooned a whale on the coast of Guinea, after a while it sunk dead to the bottom in thirteen fathoms water; and his boat remained hanging to the prize by the line from the harpoon in the whale, with three other boats attached to the stern of his boat, till the whale should float by its change of specific gravity. During this period a heavy gale came on to blow towards the shore; but the strength of this single line was enough to hold all the four boats to their object, till the gale abated. This surely is a convincing proof that whale-line is sufficiently strong for the cable, and other purposes of the life-boat in question, the dimensions of which are nearly similar to a whale-boat.

The long parallel form of the vessel may be objectionable in the eyes of a builder; but it was given, not only because it appeared to be a form well calculated as a sea-boat; but also from its allowing a sufficiency of space along the sides within-board for the stowage of the floating capacity. Moreover, the shape admitted oars of the same length of leverage throughout, whereby all the crew are given the means of pulling with the same strength, and the confusion avoided which must ever arise when a strange crew come into a boat, the oars of which are adapted by their lengths to particular places.

Where

Where the present boat is to be stationed, she may be launched at most times with readiness; but in such places where difficulties are presented by a heavy surf heaving upon the shore, a rope or chain, from an anchor in the offing, should ever be in readiness to haul out the boat; and if the boat were slung beneath the axletree of two high wheels, such as are used for the carriage of timber, with her bow rather elevated, she may be run out beyond the surf, with all her crew on board, and floated off with much ease and safety, by casting off the sling at the proper period. Such a carriage would also be valuable to transport the vessel along the shore to a more weatherly position for reaching the wreck at sea. The wheels for a carriage of this kind should be made not dishing but upright, with a long nave, so that the mortice holes for the spokes may be cut, not central, but alternately round towards each end of the nave, as represented by Fig. 13, which is a section of such a wheel. This structure would admit of strength with lightness, which are objects of material moment.

When this design was suggested, the object in view was, to form a small life-boat at a moderate cost, of good floating capacity, and capable of carrying six or seven extra men in safety, even when filled with water, and of so light a structure as to be readily transported from one position to another—possessing also the very essential qualities of a dry and good sea-boat, of steering well, having the capability of being propelled out to sea with facility either by oars or by canvass, and of taking the beach in safety on her return. It was moreover presumed, that were two light boats of the kind to be preserved at the same station, they would prove more effective than one of double the cost and magnitude; for as yet it has not been shown that a vessel of magnitude is
more

more equal to the duties of a sea-boat than a smaller. For instance, where is the boat so alive to its purpose in all weathers as the little Esquimaux canoe? With this fact before us, why are we not, in some measure, to follow the example placed before us by these simple-minded Indians, and effect our purpose in smaller boats, which are less costly and more readily managed? It may, too, happen that enough seamen cannot be collected to man a large heavy life-boat, while a sufficiency may be at hand to man a smaller: but admitting that enough should be collected to man the larger, with how much more spirit would they proceed to effect their object in two smaller boats, as each would be at hand to help and sustain the other? Indeed, on the occasion of all adventurous boat enterprises, the confidence and emulation, even to heroism, that are created by having boats in company, is well known to every seaman. Each boat is pushing to be foremost to cope with the object, whatever it may be. Whether on board or on shore, human nature is the same; and on the occasion of a dangerous rencounter, all are more alive to meet it when united than alone.

Had the delivering tubes been of larger bore, they would have effected their purpose with greater facility, or this duty would have been better and more cheaply accomplished by cutting out the plank of the bottom amidships, between the two middle thwarts, to the width of the cases; then by boxing this space up to the height of the present tubes, so as to form a square well, which might be prevented from leaking by a lining of lead or copper, a much greater area would have been given for the self-delivery of the water from the boat.

A boat of this description should be under the constant charge of one active seaman or coxswain. who is capable
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of stationing her chance crew to their proper duty, and himself expert at the management of her steerage by the oar at the stern. Without this advantage the boat may almost be considered as useless, and such unfortunately is the case with the boat in question; for she is not only without a fixed coxswain, but at a station, although excellent in many respects, where seamen do not reside.

Experiments in reaping Barley, at different Stages, in its Progress towards Ripeness.

From the FARMER'S MAGAZINE.

SOME observations, lately circulated by Sir John Sinclair, regarding the stage at which it is proper to apply the sickle to corn crops, led to an experiment, of which the following is a detail. As it was conducted on a minute scale, it may not be regarded as very conclusive; but considerable pains were taken in endeavouring to equalize the *criteria*; and such an experiment, perhaps, affords facilities for this, which an extensive one might not command, as a slight difference, either in the quality of soil, in the preparation of land, or in other obvious circumstances in an experiment on a large scale, might occasion error greater in the one case than what is likely to attend the other.

A particular spot, in a field of barley, having been selected for the trial, twenty-four stalks of grain, all as nearly as possible of the same size and state of advancement, were cut close by the ground, at different periods; and each parcel, being tied up and labelled, was suspended in a room. The following are the dates of reaping, and the appearances of the plants when cut:

August

August 11th.

1st. 24 stalks.—The ear pretty well filled, but soft and quite green. The stem and hose also green, and the leaves very partially decayed.

August 18th.

2d. 24 stalks.—The ear full and plump, but still green, and the grain soft and pulpy, so that it separated from the husk on a slight pressure between the finger and thumb. The stem quite green. The hose withered on the lower joint, but green on the upper. The leaves almost withered.

August 25th.

3d. 24 stalks.—The ear firm, and with its awns beginning to assume a yellowish hue. The grain doughy, and no longer to be separated from the husk by pressure of the fingers. The lower part of the stems turning to straw colour; the upper part still green, or very little changed. The upper part of the hose, on the side towards the sun, changed to straw colour. The leaves quite withered.

September 1st.

4th. 24 stalks.—Awns quite withered. Ear straw colour, with a remaining tinge of green. The hose faded, except in the upper joint, where it is still somewhat green. The stem quick, but yellowish at the foot; and, immediately below the ear, *nearly* changed to straw colour. The grain still soft and doughy.

September 6th.

5th. 24 stalks.—A slight tinge of green remaining on the ear. Part of the hose still quick. The stem also quick, but, immediately below the ear, *entirely* changed to straw colour. The grain still soft, and easily crushed between the finger and thumb.

September 11th.

6th. 24 stalks.—Awns, ear, stem, and hose, completely straw colour. Grain still soft; but the field, on the whole, in the state of ripeness commonly esteemed sufficient; and accordingly it was this day begun to be reaped.

On the 10th of October, by which time the parcels were properly dried, the grain was carefully rubbed out, and subjected to an operation equivalent to a complete winnowing, each parcel being still kept separate from the others.

The produce of No. 1 was found shrivelled and imperfect, and that of No. 2 little, if at all, superior to what is usually dressed from good grain by the fanner. With regard to these two parcels, it is obvious they were cut when, with a view to weight of grain, reaping would be improper. It is presumable, from their appearance, that they would both vegetate; and it may be desirable to ascertain whether barley, reaped in the state of either of these parcels, might safely be used as seed; because, if so, an evident advantage would arise from the additional value which the consequent preservation of its juices would give to the straw, while, perhaps, as seed, the grain might go as far as when perfectly ripened.

The produce of No. 3 was also defective, being what is termed hungry, and containing a large proportion of light grain; but it was not, upon the whole, of a quality which would be considered unmarketable.

Nos. 4 and 5 had the appearance of maturity, but contained more light grain than No. 6; from which it may be inferred, that a crop reaped in the state in which they were, would not, *ceteris paribus*, prove as productive as one reaped in the state of No. 6, although it may deserve to be considered, whether, in a late and precarious season,

season, the benefit is equal to the risk of delay in reaping, after the crop has arrived at the state of No. 5.

The six parcels were subjected to various tests, by measure and weight, with a view of determining their comparative value; and the results appeared to warrant the following statement of their relative proportions:

No. 1 being as 40	No. 4 was as 89
No. 2 was as 59	No. 5 - - as 91
No. 3 - - as 77	No. 6 - - as 95

A greater difference, it will be observed, is noted between No. 5 and No. 6, than occurs in a similar space of time between No. 4 and No. 5; and this may be attributed partly to an improvement in the weather, which had become more favourable for a week before No. 6 was reaped than it had been previously; and partly to the accelerated progress towards maturity, which it is supposed crops acquire in the latter stage of ripening. It appeared, also, that although No. 6 was proportionally heavier, *upon the whole*, than No. 5, yet this parcel contained a considerable portion of grains equal to the best in No. 6; so that the superiority of the latter seemed to have proceeded entirely from the improvement of the lighter grains in the period between the 6th and the 11th of the month. If, in that period, high winds, or weather otherwise unfavourable, had ensued, the consequence might have been, to turn the scale in favour of No. 5, and to afford an instance of the danger of delay in reaping, after the most valuable part of the crop has attained maturity.

On the Cultivation of the English Cranberry (Oxycoccus palustris), in dry Beds.

By Mr. THOMAS MILNE, F. H. S.

From the TRANSACTIONS of the LONDON
HORTICULTURAL SOCIETY.

Dec. 10, 1822.

THE sample of English Cranberries which I had the honour of sending to the Horticultural Society on the 2d of September last, were gathered from cultivated plants growing on a bed made in the same way, in every respect, as for rhododendrons, azalias, andromedas, and other plants, generally denominated American. The soil was brought from Wimbledon Common, and was of that kind known by the name of black heath-mould, or peat, with a considerable quantity of white sand amongst it. The sand I, however, do not consider very essential to the growth of the *oxycoccus palustris*, and if we may judge from the soils on which it grows naturally, it would perhaps be as well, or better, without it. The plants were put into the bed in the spring, at about one foot from each other every way, but I believe they would grow equally well if planted at almost any other time of the year, except during the hot summer months, when there would be a greater risk of losing some of them, unless occasionally shaded and judiciously watered. As their slender shoots advanced, they were constantly laid into the ground about two or three inches deep, in order that they might the more certainly root, and be less influenced by the heat and dry weather in summer. This I consider of much importance, and am of opinion that it is in a great degree owing to that circumstance that the plants have been so little affected by the extreme heat of the last summer. In two years the plants completely covered the bed, and last year (the third) they produced a
crop

crop of fruit which you had an opportunity of seeing. You then expressed an opinion that it might be desirable for the Horticultural Society to know the method of cultivating the English cranberry so successfully on dry beds. But as the greater part of that season, 1821, was singularly wet and cold, I was led to suppose that circumstance might have been the cause of their then making such vigorous shoots, and I therefore thought it better to suspend my opinion concerning them till I saw what effect a dryer season would have on both the plants and fruit. The last, one of the hottest and driest I ever remember, afforded me the opportunity I wished for, and I have had the satisfaction to observe that the plants have continued nearly as vigorous, and the fruit has ripened as well as in 1821, though a month earlier. As the produce was gathered at different times, to gratify the curiosity of ladies and gentlemen who visited our grounds in the course of the season, I cannot say exactly the quantity of fruit produced on a given space, but I think it was certainly not less than one quart on a bed five feet square, and I have no doubt, that, when the plants are more disposed by age to produce flowers and less vigorous shoots, the same space will yield a much greater crop. Some part of the bed is a little shaded by low pales, but how far that is a benefit to the plants, I do not pretend to say; last summer it became necessary to water all the American plants, and the cranberry bed had an equal share with the rest, but not greater; in 1821 no artificial watering was necessary. The subsoil over which the bed is made is a sandy gravel, therefore not retentive of moisture, which is against the successful cultivation of this plant on dry beds; but where the soil is naturally moist or damp, with a free air, advantage might be taken of it, and the English cranberry might be cultivated on
it

it with much success. On a bed in a similar situation, and of the same sort of soil, the American cranberry (*oxycoccus macrocarpus*), grows most luxuriantly, but as a valuable paper on the cultivation of that species has been published in the Transactions of the Horticultural Society by Mr. Hallet*, I consider it unnecessary to add any thing to his directions and observations, which are plain, and if followed, will be attended with success.

I have been long convinced that both species may be grown with much advantage in numberless situations in this island, and have been surprised that cottagers and others living on or in the neighbourhood of moors and heaths, covered with soil suitable for their growth, have not been advised to cultivate them for the sake of profit. According to Withering's quotation from Lightfoot†, twenty or thirty pounds worth of the berries are sold by the poor people each market day for five or six weeks together, in the town of Langtown, on the borders of Cumberland. This is a considerable sum for berries picked up from barren wastes, and in a district so thinly inhabited; and it is remarkable that the ready sale for them has not tempted some person to make the trial to supply the market in a more certain and regular way: if they could not be consumed or disposed of in the immediate neighbourhood, where they may be grown, they could easily be sent a great distance without the hazard of being spoiled. There is one very strong argument in favour of their cultivation, which is, that they may be made to grow with little trouble in places and on soils where few other useful plants yet known will grow to advantage. It may be said that the demand for them will be limited and uncertain; but that may have been said

* See Repertory, vol. XLII. p. 306.

† Withering's Syst. Arr. of British Plants, 5th edit, vol. II. p. 462.

of a number of other things of a similar nature, which now meet with a regular sale, and which the growers of course endeavour to cultivate according to the demand they have for them. If to supply the whole of Great Britain only the produce of one hundred acres were required, it would at least be one step towards making that quantity of waste land useful in some degree, and probably suggest some other improvement in various ways. Should any person be induced to make the trial, there can be no doubt the American cranberry would be the easiest managed, and most productive for general use; but as many prefer the flavour of the English cranberry, there would also be a demand for it on that account, though at a higher price.

On the Oxyds of Manganese.

By M. BERTHIER, Mine Engineer.

From the *ANNALES DE CHIMIE ET DE PHYSIQUE*.

(Concluded from line 6, page 61, after the word *quantity*.)

AN obscure red heat begins to disengage both water and oxygen at the same moment, as may readily be seen by heating the hydrate in a narrow glass tube, and collecting the products.

When I employed the hydrate prepared by an excess of chlorine, and thoroughly dried in a boiling-water heat, I obtained, on an average of very many experiments, the following results;

Red oxyd	0.77
Oxygen	0.11
Water	0.12
	1.00

Now

Now, according to Berzelius, 0.770 of red oxyd and 0.106 of oxygen form the peroxyd; and therefore the hydrate analized had the peroxyd for its base; but the hydrate does not contain water in any very simple atomical proportion, and, in fact, the water holds in its composition a quantity of oxygen equal to that which is expelled from the hydrate by calcination, and which is the third part of the whole of the oxygen which the peroxyd contains.

The hydrates prepared with less chlorine than would bring them to the state of hydrated peroxyd, and deprived of the carbonate by weak nitric acid, have all given me nearly 0.12 of water, and 0.04 to 0.08 of oxygen. They are, therefore, mere mixtures of the two; for the hydrated deutoxyd should yield only about 0.08 of this gas.

When rather concentrated, nitric acid is boiled upon the hydrate of deutoxyd or hydrate of peroxyd, a portion of it is dissolved, oxygen is evolved, and a new hydrated peroxyd is generated, which contains less water than the hydrate produced immediately from chlorine. This new hydrate, when washed and stove-dried, is in compact tenacious lumps, with an earthy fracture, a brownish-black colour, and cohering into a pasty mass under the pestle.

It gave me, by analysis,

Red oxyd	0.840
Oxygen	0.115
Water	0.045
	1.000

It appears, therefore, to contain only a third as much water as the former hydrate.

On the Hydroxanthic Acid, with some of its Products and Compounds. By Mr. W. C. ZEISE, Professor of Chemistry at Copenhagen.

Abridged From the *ANNALES DE CHIMIE ET DE PHYSIQUE.*

THE following results, which appear remarkable, occurred during a series of experiments on the mutual action of carburet of sulphur, potash, and alcohol.

Potash or soda dissolved in alcohol may be neutralised by carburet of sulphur, though this liquid does not change litmus, nor does it neutralise the alkalies, either dry or dissolved in water. This phenomenon is owing to the formation of a peculiar acid, produced by the mutual action of the carburet and alcohol, and determined by the alkali.

The new acid contains sulphur, carbon, and hydrogen. The two former elements probably unite in this compound, and perform the same part that cyanogen does in the hydro-cyanic acid. I have given the name of *xanthogene* to the compound radical of carbon and sulphur, from the yellow colour of many of its metallic compounds, and to the new acid compound I have given the name of *hydroxanthic*, having all the characteristic properties of an acid.

Pure carburet of sulphur readily dissolves in the alcoholic solution of potash; and the result is a liquid, yellowish green at first, which is easily observed by using the alkaline solution, made in the cold before it begins to grow brown. When the solution is fully saturated with the carburet, and cooled down to the freezing point of water, it will soon congeal into a mass of fine crystals,

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which, when quickly dried between folds of blotting paper, is the pure *hydroxanthate of potash*. The same crystals may also be obtained by evaporation of the liquid that holds it dissolved, by means of the vacuum of the air-pump maintained by sulphuric acid. Even spontaneous evaporation will answer the same purpose, or precipitation by sulphuric ether.

The exact process by which I usually obtain the *hydroxanthate of potash* is the following: to one part of pure well-dried potash, enclosed in a ground-stoppered bottle, I add about 12 parts of alcohol, containing 96 to 98 *per cent.* in volume of pure spirit; I digest this mixture with frequent agitation, in a temperature of 68° to 75° Fahr. for two or three hours, and filter the solution. Immediately after, I add pure carburet of sulphur, till the liquor ceases to redden turmeric paper; and to be sure of saturation, I add a slight excess of the carburet, till a few drops of the mixture poured into water deposit oily globules; I then pour the whole into a glass capsule, whose sides are perpendicular; for with one of the ordinary shape the salt as it forms climbs up the sides and flows over the edge; and I immediately place it in the exhausted receiver of an air-pump. When it appears to me that the excess of carburet has thus been evaporated, I introduce into the receiver a vessel of sulphuric acid, and again produce the vacuum. After a while I exchange this acid for a fresh portion, as the former becomes diluted, and continue the application till the capsule is nearly empty. A little pure sulphuric ether then determines the fixation of the salt; which is first dried by pressure between paper, and lastly completely desiccated in the exhausted receiver.

This process succeeds best in winter, or where there is an opportunity of surrounding the apparatus with ice.

Evaporation

Evaporation in the open air has this inconvenience, that the salt generally turns yellow, and then it makes a somewhat milky solution in water. Care must be taken not to use too concentrated a solution of potash in alcohol; otherwise the mixture congeals immediately after saturation, and a little sulphuretted hydrogen may be generated.

Hydroxanthate of Potash.—This salt prepared in the way above described is in needled crystals, colourless, and very brilliant; in the air it turns slightly yellow; its smell is peculiar; its taste is at first very cool, then sulphureous and pungent. It is extremely soluble in water, and yet it does not deliquesce. If fresh made, it dissolves also in alcohol with ease, but not so abundantly as in water; sulphuric ether has hardly any action upon it; petroleum none. A solution of this salt in water becomes milky by exposure to air, and in time slightly alkaline; so that the test papers, which at first come out from the solution unchanged, after a while shew in their altered tint the predominance of an alkali.

If concentrated acetic, muriatic, or sulphuric acid is poured upon the hydroxanthate of potash, no effervescence follows; but if either of the two latter acids are diluted with four or five parts of water, they separate from the salt a liquid, heavier than water, and exactly like oil in appearance, and this is the *hydroxanthic acid*.

Neither barytic water, nor muriate, nor nitrate of barytes, muriate of lime, sulphate of magnesia, nor alum, produce any precipitate in the solution of hydroxanthate of potash in water; but white precipitates are formed by sulphate of zinc, nitrate, and acetate of lead, deuto-chloruret, and cyanuret of mercury. A beautiful yellow precipitate arises from the addition of sulphate, muriate,

muriate, or nitrate of copper; and also from chloruret of antimony, and the salts of bismuth and tin. The precipitate from nitrate of silver or corrosive sublimate soon pass from yellow to black. None of these precipitates effervesce either with sulphuric or muriatic acid.

If a perfectly neutral solution of hydroxanthate of potash is inclosed in a close vessel, it may be heated for half an hour as high as 140° without losing its characteristic properties; but if it is previously rendered alkaline by potash, heating it will give it the power of precipitating salts of lead black.

If hydroxanthate of potash is gradually heated in a small retort with a receiver, and a curved tube to collect the products under mercury, the following appearances occur: no change takes place up to a heat of about 140° Fahr.; but above this it gives out oily vapours, which melt with a strong effervescence, emitting much gas and vapour, and the salt becomes a blood-red mass, which retains its colour when cooled. The vapours soon condense into an oily fluid. A higher heat causes the red mass again to effervesce, and to give out more oil and gas. After a time, however, the saline mass enters into quiet fusion, giving out nothing even at a cherry-red heat. On cooling, the mass divides into two parts, the inferior, obviously crystalline, of a grey-black, and a metallic splendour; the upper, simply a black amorphous mass. On further urging the heat all appearance of crystallisation passes away.

The gas given out in this distillation has a very strong smell like garlic, and appears to be a mixture of carbonic acid and sulphuretted hydrogen. The constitution of this, as well as of the oil, seems to be uniform through the whole process.

Xanthic

Xanthic Oil.—This is a limpid yellowish liquid, of a very strong and peculiar odour (neither that of sulphuretted hydrogen nor of carburetted sulphur), which adheres long and strongly to every substance impregnated with it. Its taste is both sugary and very pungent. Water dissolves it scantily; alcohol, even much diluted, abundantly. An addition of water makes this latter solution milky, but more water makes it clear again. Xanthic oil has no effect on the colour either of litmus or turmeric; nor does it in any way alter nitrate of lead or muriate of copper. It easily kindles by any burning body, burns with a blue flame, and in so doing produces much sulphureous acid; a bell-glass held over the flame is soon studded with drops of water.

Red residue.—This is deliquescent, dissolves completely in water into a reddish liquid, which soon becomes brown, and strongly reddens turmeric. Alcohol has but little effect upon it. Its solution in water, if recent, reddens the salts of lead, which soon turn black. The red residue effervesces strongly with acids, giving out the odour of sulphuretted hydrogen mixed with that of carburet of sulphur: globules of an oily fluid are expelled at the time, but no sulphur makes its appearance. Paper imbibed with nitrate of lead, exposed to the gas disengaged by muriatic acid, is coloured partly black, partly red.

Crystalline matter.—This readily deliquesces, and water dissolves it without residue. The solution is a very intense black brown, almost opaque; acids expel sulphuretted hydrogen from it, and a small portion of sulphur. The residue left in the retort, after applying a red heat, is highly deliquescent and alkaline, and appears to be a mixture of sulphuret of potash and charcoal.

Hydro-

Hydroxanthate of potash, if projected upon a red-hot plate of glass, easily takes fire, and burns quickly with a blue flame; but if it is kindled at the point of the flame of a taper, it burns with much energy, emitting very brilliant sparks. If the salt is presently removed from the flame, the combustion stops, and leaves a red melted mass, which however re-kindles in the flame, and burns with increased brilliancy. The same red mass is left after quiet combustion on hot glass, which will burn like the last, with many sparks, on applying a lighted taper.

If the hydroxanthate of potash is prepared by adding sulphuric ether to the alcoholic solution, the liquor from which the former salt has separated, if kept for some time in a close vessel, will deposit crystals much resembling sulphate of potash. This latter salt is also found in any solution of the hydroxanthate when long kept.

The hydroxanthate of soda and of ammonia are formed by adding alcoholic solutions of these alkalies to carburet of sulphur.

The hydroxanthates of barytes and of lime are produced by dissolving the carbonate of these earths in the hydroxanthic acid, which will be presently described. The latter neutral salt is also produced by the mutual decomposition of hydroxanthate of potash and muriate of lime.

Most of the *metallic xanthurets*, or precipitates produced by decomposing the respective metallic salts with hydroxanthate of potash, consist probably of *xanthogene* (or the basis of this acid), with the metal of the salt employed.

TO BE CONTINUED.

List

List of Patents for Inventions, &c.

(Continued from Page 192.)

THOMAS BEWLEY, of Mount Rath, Queen's county, Ireland, Cotton-manufacturer; for certain improvements in wheeled carriages. Dated January 24, 1824.

JOHN HEATHCOAT, of Tiverton, Devonshire, Lace-manufacturer; for certain improvements in the method of figuring or ornamenting various descriptions or kinds of goods manufactured from silk, cotton, or flax. Dated January 24, 1824.

JOHN JONES, of Leeds, Yorkshire, late of Gloucester, Brush-manufacturer; for certain improvements in machinery and instruments for dressing and cleansing woollen, cotton, linen, silk, and other cloths or fabrics; and which improvements are also applicable to the dressing and cleansing of machinery of various descriptions, and other articles or substances. Dated January 27, 1824.

Sir WILLIAM CONGREVE, of Cecil-street, Strand, Middlesex, Bart.; for an improved method of stamping. Dated February 7, 1824.

JOHN ARROWSMITH, of Air-street, Piccadilly, Middlesex, Esq.; for an improved mode of publicly exhibiting pictures or painted scenery of every description; and of distributing or directing the day-light upon or through them, so as to produce many beautiful effects of light and shade, which he denominates Diorama. Partly communicated to him by certain foreigners residing abroad. Dated February 10, 1824.

ROBERT LLOYD, of the Strand, Middlesex, Hatter, and **JAMES ROWBOTHAM**, of Great Surrey-street, Blackfriars-road, Surrey, Hat-manufacturer; for a hat upon a new construction. Dated February 19, 1824.

HENRY

HENRY ADCOCK, of Summer Hill-terrace, Birmingham, Warwickshire, Gilt Toy-manufacturer; for an improvement in making waistbands or umbilical ventral lumbar and spinal bandages or supporters, to be attached to coats, waistcoats, breeches, pantaloons, and trowsers, to be either permanently fixed, or occasionally attached and supplied. Dated February 19, 1824.

WILLIAM CHURCH, of Birmingham, Warwickshire, Esq.; for certain improvements in machinery for printing. Dated February 19, 1824.

AUGUSTUS APPLGARTH, of Duke-street, Stamford-street, Blackfriars, Surrey, Printer; for certain improvements in machines for printing. Dated February 19, 1824.

Rev. MOSES ISAACS, of Houndsditch, London; for certain improvements in the construction of machinery, which, when kept in motion by any suitable power or weight, is applicable to obviate concussion, by means of preventing counteraction, and by which the friction is converted into an useful power for propelling carriages on land, vessels on water, and giving motion to other machinery. Dated February 19, 1824.

JOHN VALLANCE, of Brighton, Sussex, Esq.; for a method of communication, or means of intercourse, by which persons may be conveyed, goods transported, or intelligence communicated, from one place to another, with greater expedition than by means of steam carriages, steam or other vessels or carriages drawn by animals. Dated February 19, 1824.

THE
REPERTORY
OF
ARTS, MANUFACTURES,
AND
AGRICULTURE.

No. CCLXIII. SECOND SERIES. April 1824.

Specification of the Patent granted to STEPHEN WILSON, of Streatham, in the County of Surrey, Esq.; for certain Improvements in Machinery for Weaving figured Goods. Partly communicated to him by Foreigners residing Abroad. Dated March 8, 1821.

With a Plate.

TO all to whom these presents shall come, &c.
NOW KNOW YE, that in compliance with the said proviso, I the said Stephen Wilson do hereby describe and ascertain the nature of my said improvements, and a manner in which the same may be performed by a description thereof, referring to drawings and figures annexed; that is to say:

The said improvements do consist in a pattern machine, by means of which the cards, slips, or pasteboards, which direct the pattern, and which are used in the weaving apparatus already introduced into this country, are punched, pierced, or stamped, with any number of holes at one operation, and by means of

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LI which

which machine also all the punches required for this one operation are placed in their respective situations by machinery, connected with or relating to cards, in the nature of a false simple, on which the pattern of the work to be performed is first read in. And also, that the said improvements do, moreover, consist in a weaving apparatus, so arranged, that it may be extended or multiplied to any distance or number along the loom, and thereby may be adapted to the weaving of broad-figured works, and with a long lever, so placed, that it will give a power to the foot of the weaver, that will enable him to draw the heaviest mountures and figured works by treading, without the use of a draw-boy. And also, that the said improvements do, moreover, consist in a certain loop, formed on to the end of each of what are called the needles, used in the weaving apparatus already introduced into this country, as also in a regulating pin, horizontal wire, and particular adjustment of this loop to the springs, as will be hereinafter described.

DESCRIPTION of the DRAWINGS and FIGURES annexed.

Fig. 1 (Plate XII.) represents the pattern machine, which is, in fact, a kind of false simple, the pattern being read in upon it, and subsequently transferred to the loom, in a manner to be hereinafter described. A, A, A, A, a, a, are a series of endless cords, passing under the rotating wooden cylinder B, at the lower part of the wooden frame-work C, C, C, C, C, and above, over mullets or pullies rotating in the frames D D; such mullets or pullies, and frames, constituting the tables commonly used by weavers. On each of these endless cords, at E, is a small trasversing ring; fastened to each of these rings,

Fig. 11.



Fig. 14.

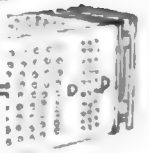


Fig. 17.

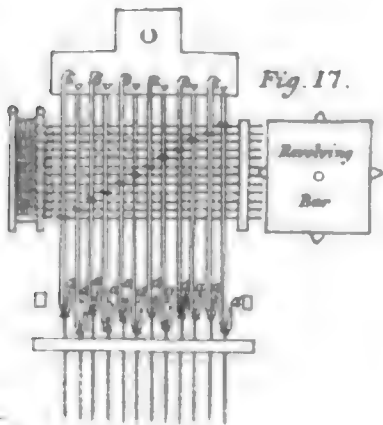


Fig. 1



12.



Fig 18.

Fig. 5.

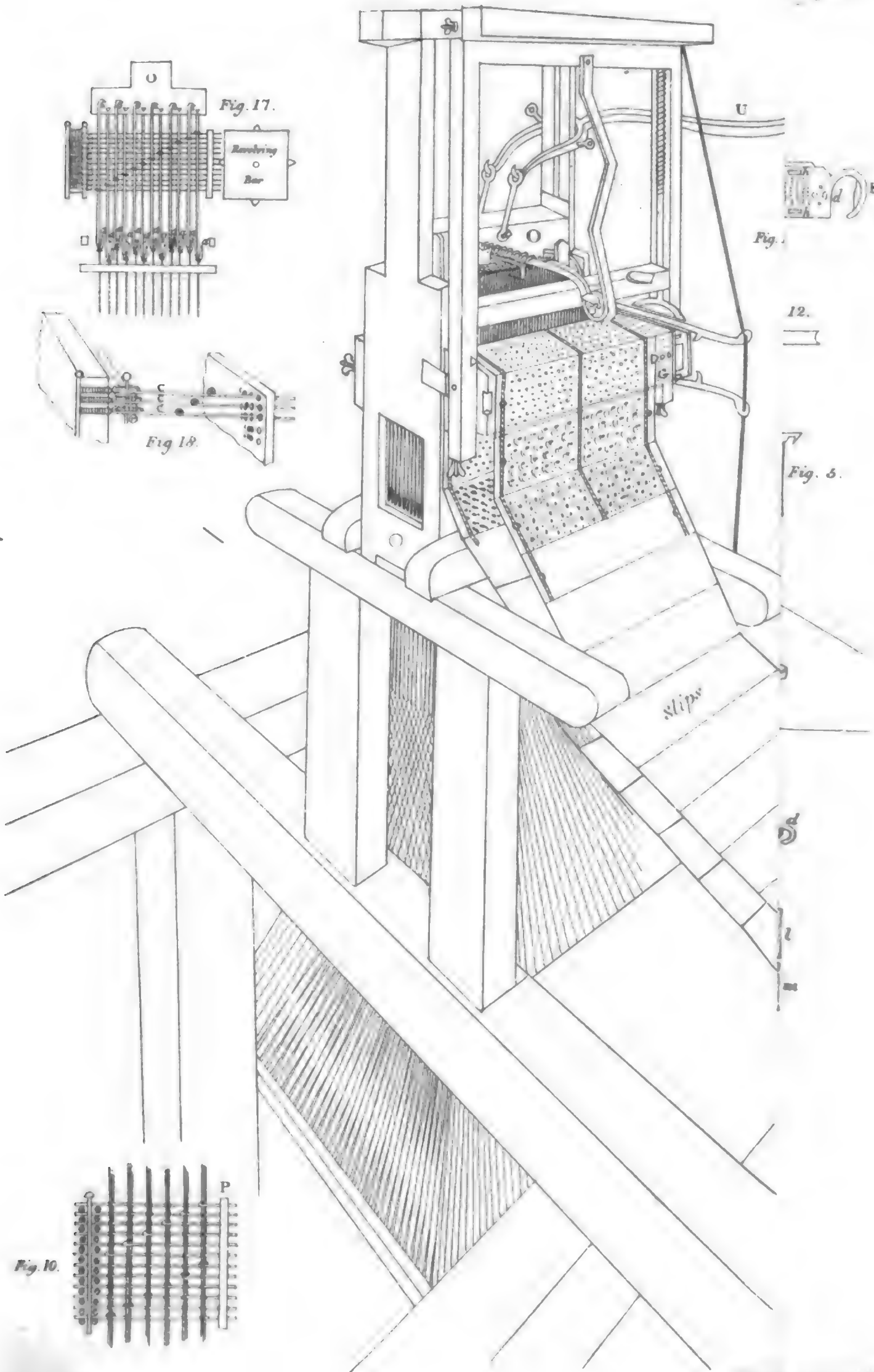
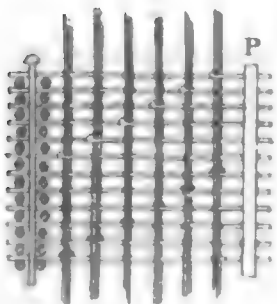
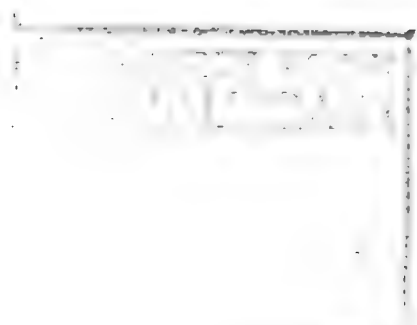
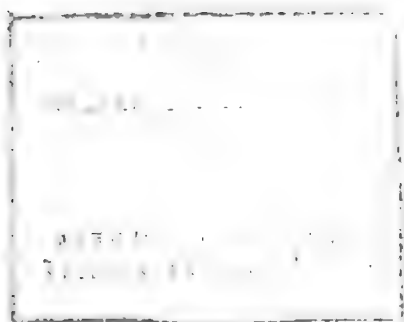


Fig. 10.





rings, and appending, perpendicularly from it, is a single thread, having a lingoe or weight at its lower extremity F. From and under the frame-work at *b* is suspended a board G, resembling a common comber-board, being pierced with holes, in number and situation corresponding with the perpendicular threads which pass through them, and serve to keep these threads distinct from one another. At little *d* the endless cords pass through certain wires contained in a small wooden frame H, let in between the two uprights of the frame-work C, C, C, C C, at *c c*, and there screwed to them; but as this frame cannot be described in this diagram, for an explanation of this part of the machine I must refer to the next figure; the threads are crossed at L L, which are rods for keeping the cross.

Fig. 2 represents the entire of one endless cord, and part of another. At *d* it will be seen that each of these cords passes through an eye, formed on a piece of stout wire, which I call a punch-projector. The broad end of the punch-projector, formed by the return of the wire to a certain distance, slides on two horizontal wires, situated at right angles with it, sections of which are shewn at *e, e, e, e*. These wires extend from side to side of the small frame H. *f*, is a small regulating pin, with a head or shoulder at the top, passing through the loops formed by the broad end of the punch-projector, thereby confining its motion to a determined extent. The front P, of the small frame H, is perforated with holes, corresponding in size, number, and position, with the punch-projectors, and through which the punch-projectors protrude when the back part of the loop, at their broad end, is advanced to the regulating pin *f*. It will be seen, by this diagram, that this motion may be given to either of the punch-projectors, by advancing that endless cord which

passes

passes through the eye formed upon it in the direction from I, to J, while the lingoe F will return it to its former position. It will be proper here to observe, that although only two punch-projectors are here represented, for the purpose of more clearly explaining the principle on which they act, there must, in fact, be as many punch-projectors as there are endless cords. These punch-projectors being placed, for the sake of a compact arrangement, in columns, one above another, as well as in horizontal rows, care must be taken, when the endless cords are passed through the eyes formed on them, that a regular and corresponding arrangement be preserved between the cords and punch-projectors. That which I have found most convenient, has been to pass the first cord (which will of course, in reading in, be counted from the back of the machine,) through the eye of that punch-projector which protrudes through the upper left corner hole of the front P of the small frame H; the second endless cord through the eye of the punch-projector next below it, and so on to the bottom of the first column of the holes, and then return to the top hole of the second column, so that where the column consists of eight holes, as in the machine herein describing, Fig. 3, the ninth cord will pass through the eye of that punch-projector which protrudes at the top hole of the second column. There must of course be a regulating-pin to each column of punch-projectors. The number of punch-projectors, and their disposition into columns or rows, may be determined according to circumstances, and the pattern required. Q, is a section of what I call the punch-holder, and which consists of a thick brass plate, perforated with holes, which I call cells, corresponding in number and situation with the holes herein before described in the front P of the small frame H, but considerably

siderably larger. The size I prefer is two-tenths of an inch in diameter. This brass plate, when in use, is attached to that part of the frame-work C, C, C, C, C, at *cc*, exactly over the front P of the small frame H, in such manner that the centres of the holes in the front P, and of the cells in the punch-holder Q, may exactly correspond. In this situation the cells of the punch-holder are filled with punches, made of a size to move easily in the cells, and which will be hereafter more particularly described. This being done, it will be perceived, that by advancing one of the endless cords, as shewn at I, the punch-projector will be protruded into the cell of the punch-holder, immediately opposite to it, thereby displacing the punch, which will be received into R, which I call the punch-receiver, and which I shall now more particularly describe.

Fig. 3 represents this punch-receiver, which consists of a thick steel plate, perforated with holes, corresponding with the cells in the punch-holder Q, Fig. 2, and similar to them, except that they are somewhat smaller in diameter, and are counter-sunk at the back, in order to admit the head of the punch so that it may be flush with the back of the punch-receiver, the head of the punch being made large to prevent its passing through the punch-receiver, though permitted to pass into it. There are many modes of placing the punch-receiver in a situation to receive the punches projected from the punch-holder; but that which I have adopted is as follows,—projecting at right angles from the punch-holder are two steel guide-pins over which the punch-receiver slides, the guide-pins passing through the perforations *dd*. These guide-pins and perforations must be so regulated that the centres of the holes in the punch-receiver exactly correspond

respond with the centres of the cells in the punch-holder. K K are the handles.

Having now described the principal parts of the pattern-machine, I shall proceed to describe the manner or process of transferring the pattern to the punches. The pattern being read in, in the ordinary way; on that part of the endless cords A a, below the rods L L, it is passed under the rotating cylinder B to a height sufficient for a person standing in front of the machine to reach with convenience. This person must then take the upper thread of the pattern, commonly called a beard, and draw it towards him sufficiently forward to admit of his passing the stick M M at the back of the cards, thereby keeping them separate from the others. The first beard may then be withdrawn. In this position it will be seen, that all those punch projectors, attached to the cords, which have been so drawn forward, by being themselves advanced, as hereinbefore described, will have protruded the corresponding number of punches out of the punch-holder into the punch-receiver. The punch-receiver must then be removed, and a card or pasteboard, which I call a slip, must be stamped with those punches which have been protruded, in a manner hereafter to be described. The punches having performed this duty, are removed from the punch-receiver, and replaced in the punch-holder, by the following simple means;—the punch-receiver, with the punches in it, is placed on the guide pins in its former position; and a rack of pins N, Fig. 4, which I call the returning frame, corresponding with the holes in the punch-receiver, is applied to the front of the punches, which being pressed upon by it, are returned into the cells of the punch-holder. The stick M M is then withdrawn, and a second set of cords being drawn forward

forward by the next beard in a similar manner, the whole pattern is by degrees, transferred to the punches and thence to the slips.

I will now proceed to describe more particularly the manner of stamping the slips, and for this purpose must give a more ample description of the punch-receiver, Fig. 3. At its front and back edge is a lip or groove, as shewn in the section Fig. 5, for the purpose, as will be afterwards shewn, of withdrawing the punch-receiver, with the punches, after the stamping of a slip; *h, h, h, h*, are mortices to receive corresponding tenants formed on the stamping-plate in the usual way, and for the known purpose of keeping the holes of the different plates always in the same respective positions.

Fig. 6 is the stamping-plate; *m m* are guide-pins serving as tenants, which pass through the holes *l l* in the stamping-plate, and *d d* in the punch-receiver to keep the whole steady in their respective places; *k, k, k, k*, are the tenants before alluded to. The stamping-plate consists of two plates of steel perforated in a manner similar to the punch-receiver, and united by two hinges at *x x*; the slip being placed on one plate, and the other folded over upon it, the punch-receiver with the punches in it, as taken from the punch-holder, after the operation of projecting the punches, is placed upon them; and in this position submitted to a stamping pressure. The stamping-press may be of various constructions. The one I have adopted with success is shown at Fig. 7, which is a simple screw-press worked by a lever *Z*, with a fly-wheel or fly-weights attached to its upper extremity *Y*. *S* is a steel-hinged flap, kept at an obtuse angle, with the side of the block or slab by the springs *r r*; a similar flap, but somewhat deeper, is attached to the opposite side of the block or slab. These flaps, when the block or slab is depressed,

depressed, catch under the lips or grooves shewn in Fig. 5; and, when the press is raised, withdraw the punch-receiver, with the punches, after the stamping of a slip which is thus prepared for use. R R are iron guides for the stamping-plates rabited to hold them down while the punch-receiver, with the punches, is withdrawn. The block or slab of the press should be of solid iron.

Figs. 8 and 9 are end views of the stamping block or slab.

Fig. 10 is a side view of the front of a small frame, as herein before described at P, Fig. 2, shewing a column of twelve punch-projectors, the necessary horizontal wires, and the regulating pin, with the endless cords passing through the eyes of the punch-projectors.

Fig. 11 is a punch-projector. In order to prevent confusion, the punch-projectors are distinguished by sets, each set having the eyes of the projectors formed on to them at a greater or less distance from the end than the others, by which means the cords are kept more distinct. The difference of these distances must in no case be less than the line of motion of the punch-projector.

Fig. 12 represents a punch, being a perfect cylinder, of steel, with a head a trifle larger in circumference than the cylinder, to fit into the counter-sinks described in the punch-receiver, to prevent their dropping through. The cutting end of this punch is formed by being ground in one direction on a cylinder of the same size.

I shall now proceed to describe certain other improvements which have lately been communicated to me from foreigners residing abroad, in various parts of the weaving apparatus already introduced into and used in this country.

The first improvement consists in a machine, having that part or side of it at which the revolving bar or axe carré

carré rotates, placed at one side or other of the loom, instead of towards the cane roll, as in the machines already introduced, see Fig. 13. By this arrangement an opportunity is afforded of extending the revolving bar or axe carré, and other parts of the machinery connected with it, to any required extent along the loom, towards the cane roll, and also of using two or more machines at the same loom (see Fig. 15). The advantages to be derived from this are evident, since the weaver will thus be enabled to work two or more patterns at the same time without shifting the slips on the revolving bar. The additional length that may thus be given to the revolving bar will admit of a ground harness being added, or lamms being worked, at the same time as a mounture. This is done by adding to that end of the revolving bar nearest the breast roll G, Fig. 13, additional slips, similar to those already introduced, but of course with a fewer number of holes punched in them, or these holes may be stamped in the slips before mentioned. It should here be observed, with reference to the pattern machine hereinbefore described, that where it is intended to use a ground harness, or where lamms are worked at the same time as a mounture, the pattern may be read in and transferred to the slips in the manner hereinbefore described.

The next improvement consists in having the iron lever for raising the block O (Fig. 13), placed as shewn in this figure, and with a long arm U, so that a rope, or other connecting medium V, may hang from the end of it perpendicularly at the back of the weaver. This rope must be connected at the other end to a long treadle, by which means the weaver is able to draw the heaviest mountures and figured works by treading, without the use of a draw boy.

Fig. 16 represents a revolving bar or axe carré.

The next improvement is in the needles, represented by the horizontal lines, Fig. 17, and *c, c, c*, Fig. 18, which are provided, at the extremity farthest from the revolving bar, with a long loop, see Fig. 14. This loop slides upon a horizontal wire, and has a regulating pin passing through it, its action being similar to the punch-projectors described in Fig. 2. This loop, moving between two of the horizontal wires *r r*, serves to prevent the needle from turning, thereby keeping the eye formed on the needle always in that position best adapted to facilitate the rising and falling of the lifting hooks *a, a, a, a, a, a, a, a, a, a, a*, Fig. 17. Another advantage of this loop is, that it may be made to work against a spiral spring, simply let into a cell, in the ordinary mode, but without being connected in any way with the end of the needle. The various dimensions of the weaving apparatus, and consequently of the improvements hereinbefore described, may vary at pleasure, as may also the relative dimensions; but those relative dimensions which I most approve, have been described in the drawings annexed. The various parts of the improvements may also be made of various woods or metals, or combinations of either or both, as may, by experiment, be found most suitable; but those substances which I have described are such as I have adopted, and found best to answer the purpose. Neither do I claim any right to the whole of the weaving apparatus which has already been introduced into this country, or to any part or parts of the same, except such part or parts as have been hereinbefore particularly described to be improvements upon those already introduced into this country. But a machine, by means of which the cards, slips, or pasteboards, which direct the pattern as aforesaid, are punched, pierced, or stamped, with

with any number of holes, at one operation, and by means of which all the punches required for this one operation are placed in their respective situations by machinery, connected with or relating to cords on which the pattern of the work has been read in, and also the alterations in and additions to a weaving apparatus; which alterations and additions have been hereinbefore described, and by which it may be extended or multiplied to any distance or number along the loom, and also a long lever, so placed as aforesaid, together with the loop on the needle, the regulating-pin, horizontal wires, and particular adjustment of this loop to the springs, as hereinbefore described, being to the best of my knowledge and belief entirely new, and never before used in these kingdoms, I am desirous to maintain this my exclusive right and privilege to the same.

In witness whereof, &c.

Specification of the Patent granted to BENJAMIN COOK, of Birmingham, in the County of Warwick, Patent-Tube Manufacturer; for a certain Mixture or Preparation which may be used with Advantage, in preventing the Danger of Accidents from Fire.

Dated April 16, 1822.

TO all to whom these presents shall come, &c. **NOW KNOW YE**, that in compliance with the said proviso, I the said Benjamin Cook do describe and ascertain, the nature of my said invention, and in what manner the same is to be performed; that is to say: I render all sorts of timbers, calicoes, cottons, silks, muslins, cloth, and linen of every description, incombustible by the use of a mixture or preparation, and thereby prevent accidents from fire; (namely) I take the two fixed alkalies, which
I dissolve

I dissolve in water, in such proportions as I find necessary ; if I require a very strong solution, I give to the alkali such quantity of soft water as it will take up to render it liquid, and of a consistency suitable for my purpose ; such for instance as saturating of timber for most uses. I prefer the pure fixed vegetable alkali, which I disengage from its impurities, and then dissolve it in soft water, and by this plan I obtain a solution suitable for rendering calico, cottons, muslins, silks, cloths, and linen of every description incombustible. The strongest solution which I can obtain from the pure fixed vegetable alkali, is what I prefer for rendering timbers incombustible. Into this solution I put all timbers in the plank, in which situation they must lie till the alkaline solution has penetrated through the plank ; a few weeks will generally effectuate this. I prefer using a very strong solution, but a much weaker one will render timber incombustible ; that is to say, to every one hundred weight of alkali put twenty-five gallons of water ; the strength of the solution I vary as I find needful, and according to what it is applied. If I wish to render scenes of theatres, floors of rooms, or any other wood-work incombustible with a strong solution, I pass over every part with a brush four or six times, letting it dry between each time, when the pores of the timber will become saturated with the alkali, or the surface of the thing so passed over will be covered with the alkali, and prevent any accident from fire ; but for ship timbers, and indeed all timbers upon a large scale, I would saturate the tree with alkali at once as it is fallen, and before it is barked, by means of an engine to extract or force out the sap ; then to saturate the whole by forcing the alkali through all the pores of the tree, after which it may be barked and sawed up into planks when required. All parts of vessels already built,
if

if regularly washed and saturated with a strong alkaline solution as herein set forth, will be rendered perfectly incombustible, so that ships at a very small expense may be preserved from the possibility of being injured by fire, either accidental or intentional. For rendering all sorts of calicoes, cottons, silks, muslins, cloth, and linens of every kind incombustible, I make a weak solution of the vegetable alkali in the purest state I can obtain it, and as alkali produced from some vegetables is stronger than others, the simple mode I adopt is to keep adding alkali to the water until cotton, paper, or linen dipped into it and dried will not blaze; it will char by intense heat, but not inflame; for calicoes, cottons, silks, muslins, cloths, and linen, I prefer the solution as weak as it will allow to prevent inflammability; but this solution after it is made should stand for a week or more, that all the impurity possible may settle at the bottom; it should then be drawn off into a clear earthen vessel, and again be suffered to stand for a month or six weeks, corked up in a heat nearly sufficient to produce evaporation, occasionally trying its purity by putting a portion of it into a clean flint-glass bottle holding about a pint, in order to ascertain by its clearness when it is fit for use. Before it is quite clear and proper for use, there will generally appear in it very thin transparent laminæ floating about, which will gradually sink to the bottom, leaving the solution as clear as the purest water, so as not to discolour the finest linen; it is then in a proper state ready to draw off into clean vessels for use. The article to be rendered incombustible, such as wearing-apparel, bed-furniture, window-curtains, or any other articles made of cotton, linen, silk, muslin, or cloth, should, after they are washed and wrung as dry as can be out of the last water, be dipped into the solution and wrung out as dry as possible,

ble, then dried and ironed, or mangled in the usual way.

In my patent I claim the exclusive privilege for the application of the fixed alkalis in a mixture or preparation, which will prevent the danger of accidents by fire; but I here wish to remark, that while I render timbers incombustible, by extracting the sap, and saturating or filling up the pores with alkali, such timbers are not only rendered incombustible, but are also preserved from the dry-rot, as no timber so prepared will be affected by dry-rot. To the navy and all public and private buildings this is most important.

There are thus three great principles in the application of my discovery, of which I claim the exclusive privilege;

First, The application of the fixed alkaline solution in preventing all accidents from fire to calicoes, cottons, silks, muslins, cloth, and linen of every description, bed and window-curtains, and sail-cloths;

Secondly, Its application to prevent effectually all wood-work of all sorts, either in buildings or vessels of any description, from being destroyed by fire, either by accident or intention;—and

Thirdly, The process used to render timber incombustible will at the same time completely prevent the dry-rot from ever affecting such timber so prepared under my patent.

In witness whereof, &c.

Specification

Specification of the Patent granted to ROBERT FORD, of Abingdon-row, Goswell-street-road, in the County of Middlesex, Chemist; for a chemical Liquid or Solution of Aunotto. Dated April 24, 1822.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Robert Ford do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in the following description thereof; that is to say: To make twenty gallons of the chemical liquid or solution of aunotto, I take fifty-six pounds of aunotto, more or less. I reduce it with warm water. Then I pass it through a fine sieve: let it stand seven days or longer. Then I add the leys of subcarbonated potash; a sufficient quantity to produce the colour required. The quantity and also the strength must depend on the colour it is intended to produce, and also on the quality of aunotto. (Other suitable articles may be used for this purpose.) Then I add to the above about six pints of the aqua lixivium caustic, more or less. Then I take alcohol, one hundred and ninety-two ounces, and mix the whole together, keeping it in a closed vessel.

I further declare, that as my invention consists in producing a liquid or solution of aunotto, an article I believe to be entirely new, I shall consider any similar production, whether from different articles, or variation of quantity of the aforesaid articles, or by what means they are produced, as an infringement on my patent-right, as every chemist must be aware that there are ingredients other than those mentioned above, which may with effect be made to supply their, or either of their places. In witness whereof, &c.

Description

*Description of a Vertical Kiln for drying Corn.**By Mr. JAMES JONES, of Holborn.**With a Plate.*

From the TRANSACTIONS of the SOCIETY for the ENCOURAGEMENT of ARTS, MANUFACTURES, and COMMERCE.

The large Gold Medal was presented to Mr. JONES for this Communication.

PERHAPS no subjects which can be brought under the consideration of a Society of intelligent men, whose object is the welfare of the community at large, combine so much real interest and importance as those which involve the production and preservation of the chief necessities of human life; and in this view, I believe, the great value of a speedy and effectual method of drying grain is too evident to require impressing on the minds of those, particularly, who are in the least acquainted with the business of the farmer, the corn-factor, or the miller. The frequent occurrence of crops being, on account of unfavourable weather, necessarily carried from the field in a state of considerable humidity, every one must be aware of; and the consequent reduction in the value of the produce, arising from the deterioration in its quality, cannot be less evident. The heat generated by the fermentation in the heap, together with the moisture, causes germination to take place in the grains near the surface, whereby the farina is decomposed, and the nutritive properties are in a great measure destroyed, whilst the lower part becomes mouldy, and acquires a musty smell, of the most foul and disgusting kind; but grain laid up in a perfectly dry state suffers no change, and history furnishes numerous instances of the discovery of
ancient

ancient granaries, wherein the corn has been preserved, in the most perfect condition, for a long series of years; which, if it had been stored in a state of dampness, would have inevitably been destroyed. This, in the time of wet harvests, renders essentially necessary some artificial means of speedily dissipating the moisture, which is so destructive if allowed to continue in the grain, and the only means of effecting this object is by the use of the common kilns; but which, in very bad seasons, on account of the slowness of their operation, are not sufficiently numerous to answer the purpose to the extent required, and the government find it requisite to permit the drying of grain on the malt-kiln. As an appendage to large granaries, or corn-stores, kilns are of infinite utility, both as affording the certain means of preserving the grain from any tendency to fermentation whilst lying in store, and fitting it for water-carriage, by that degree of dryness which is absolutely necessary to prevent its heating on-board, where the opportunities of turning it are so limited, if not altogether wanting, although the necessity of it is increased; and to the miller the use of a kiln is not less important, as, without a certain degree of dryness, the wheat will not grind freely, it clogs the stones, and good flour is not produced; and I believe it is a very general practice with millers, who possess the means, to pass all wheat over the kiln when the flour is intended for water carriage; at least, I know it is the custom at some mills; and, indeed, it is perfectly well known, that new flour, particularly of the finest quality, when in a damp state, has a remarkable pre-disposition to encourage the propagation of those minute insects which are so totally destructive of its good properties.

The common kiln is so well known, that little need be said in the way of description, except to enable those

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who are unacquainted with its construction to judge of the comparative merits of the old kiln and the one hereafter described: suffice it to say, that it consists of a floor, usually composed of Bridgewater tiles, which are large square flat tiles, perforated with a great number of small holes; or, otherways, of iron plates perforated in the same way; or of wove wire-work, either kind being supported on iron bearing-bars extending from wall to wall. Beneath this floor, or kiln head, as it is frequently called, are built four portions of arches of brickwork, which together compose a form somewhat similar to an inverted frustum of a pyramid, whose larger base is equal to the area of the floor; and in the lesser base, which is supported on low walls, is placed, at the distance of five or six feet from the tiles, a fire, composed of coke, culm, or other suitable fuel; the heated air and vapour from which ascends into the pyramidal space above it, spreading rather unequally over the inferior surface of the floor, passing through the perforations made in it, and through the interstices between the grain, which is spread in considerable thickness upon it; the lower part of the stratum thus necessarily gets considerably heated, and the humidity is evaporated. After a lapse of time, dependant on the state of the grain, it is turned over with a large wooden shovel, or scoop, for the purpose of removing those grains which were before at the top, nearer to the heated surface, and those which are sufficiently dried to the top; and is then suffered to remain until it is fit to be turned again, if from its previous damp state that is necessary, or to be removed entirely from the kiln, when a fresh quantity is submitted to the same operation. The length of time it lies on the kiln depends on the proportion of moisture contained in the grain, and varies from five to eight or nine hours; indeed Mr. Tull states the occasional

occasional necessity of it to extend as far as twelve hours. On the kilns used previously to the one I erected, the average time required for the purpose was seven hours and a half, during which time four quarters and a half were dried, being at the rate of fourteen quarters and a half *per* day.

The imperfections of this method are so glaring, that it must excite surprise that no effectual means have been devised to obviate them: for I believe the only alterations either effected or proposed, have been in the manner of heating, whereby the grain might imbibe less of the unpleasant flavour derived from the fuel; with only one exception that I am acquainted with, which is at a mill in Wapping, where the wheat is constantly turned over by the action of a traversing and revolving rake, similar, I believe, to that for which Mr. Barchard was rewarded by the Society.

It must be evident that a stratum of wheat several inches thick, cannot be equally heated through all its parts in a short time, and, consequently, that the moisture which is expelled from the grains nearest the tiles, by the first effect of the fire, in the form of steam, must, in its ascent, be condensed and deposited on the colder grains which are nearer to or at the surface; and, consequently, so far as regards the upper part of the stratum, the evil is doubled, and until the grain is turned over (unless that operation is excessively delayed), the upper portion does not part with any of its previous or acquired moisture, and when it is turned, it must be allowed to remain long enough to evaporate, perhaps twice its original quantity of humidity, during which time the part which was first dried re-absorbs much of the moisture exhaled from the other grains, by which the time requisite to expel the whole is greatly extended; and in this view I
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am confirmed by the very short time which proves sufficient in the mode I have adopted. Whether any, or what chemical action takes place, detrimental to the flour in this protracted state of humid heat, I am not prepared to state; but I think it will not be doubted that the least possible time in which the purpose can be effected, the less chance there is of injurious change; and I also think it will be admitted that in those kilns which are heated by the direct action of the fire, the longer the grain remains, the more it will imbibe of the unpleasant effluvia arising from the fuel; but in kilns where the drying is performed by heated air alone, this objection does not exist. The operation of turning must obviously be an imperfect and inefficient one, notwithstanding every attention may be paid by the man performing it, for it is impossible he can turn the whole completely; but, from the circumstance of its being an unpleasant operation, it is seldom performed as effectually as it perhaps might be; but, let the care and attention employed be unlimited, still, from the inequalities of the surface on which the grain lies, it is utterly impossible that the turning can be so complete, but that some of the grains remain undisturbed, and much is necessarily again brought into contact with the tiles, and therefore becomes over-dried, to the injury of the entire quantity; and, in fact, the experience of every day shows the inequality of this mode of drying, as frequently, if not always, some of the grains are quite parched, whereby the quality of the flour is much injured; while others are thrown off the kiln almost as damp as when laid on.

That the imperfections here stated attach to the use of the common kiln, every person acquainted with the subject will, I believe, acknowledge, and to such persons
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the communication of an effectual remedy will not be unacceptable.

In the latter part of the year 1821 I was applied to by John Snook, Esq. the proprietor of large mills at Bedhampton, Hants, to endeavour to effect some improvement in his kilns, so as, if possible, to obviate the existing objections, and although I acknowledge that at that time I was perfectly unacquainted with the subject, very little reflection sufficed to convince me that the principles of the old method were bad; and I, therefore, instead of attempting any alteration in the old kilns, after a good deal of consideration, proposed the adoption of one altogether new, both in construction and the manner of its operation, which I hoped would possess in an eminent degree those properties which are essential to a perfect mode of drying, and which requisites I conceive to be, the exposure of a very thin stratum of grain, an equal temperature, the passage of a very large quantity of warm air, and an uninterrupted removal or turning; each of which are indispensable where perfection is sought. This proposition was approved, and in June last year it was set to work, and the first trial sufficiently proved the superiority of the new method over the old one, for the work it did compared with one of the old kilns, which was at work a few days before, and with the same wheat, was rather more than as six to one. This, indeed, far exceeded the effect my most sanguine anticipations had suggested, and amply confirmed my previous opinion of the old kilns. Thus sanctioned by the test of experience I submit it to the consideration of the Society of Arts, feeling conscious that the importance of the subject will be thought sufficient apology for this communication, particularly as it has some analogy to the ultimate object
of

of the premium, No. 34, "For harvesting Corn in Wet Weather."

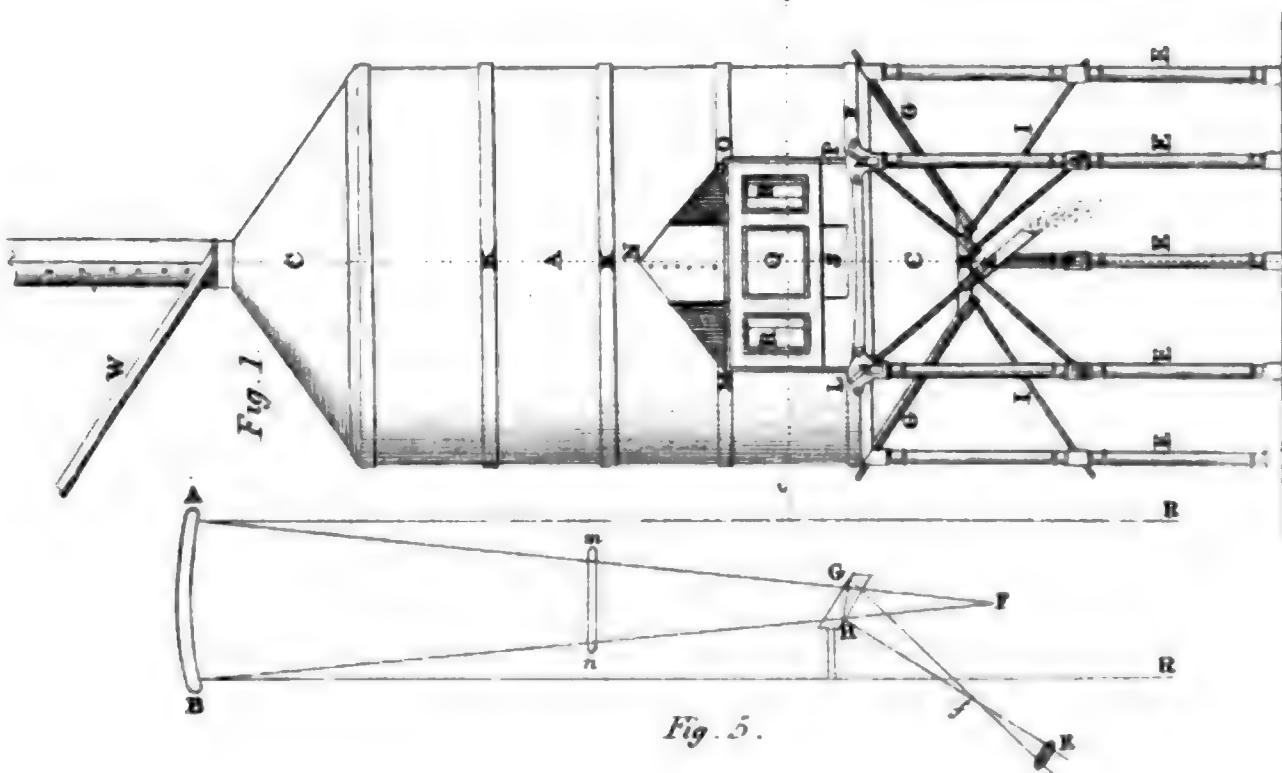
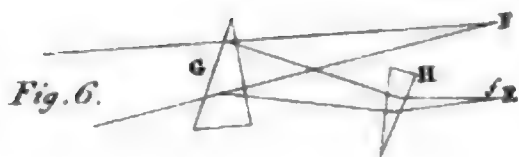
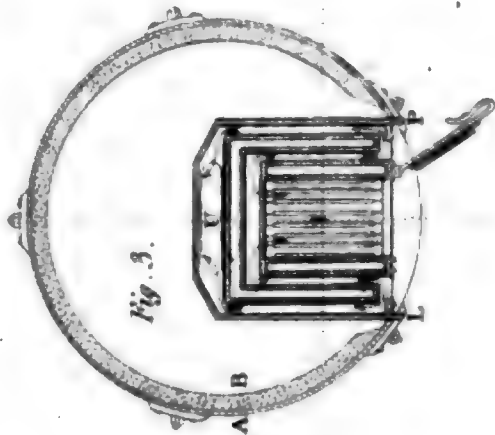
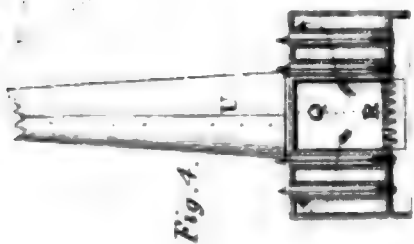
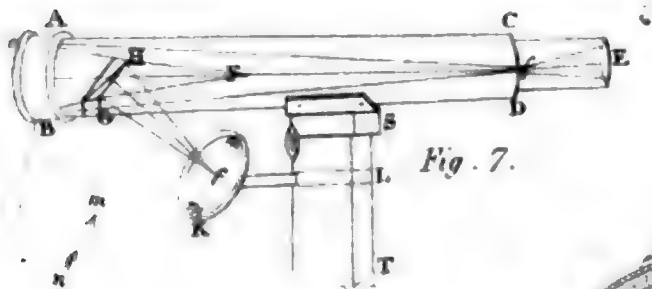
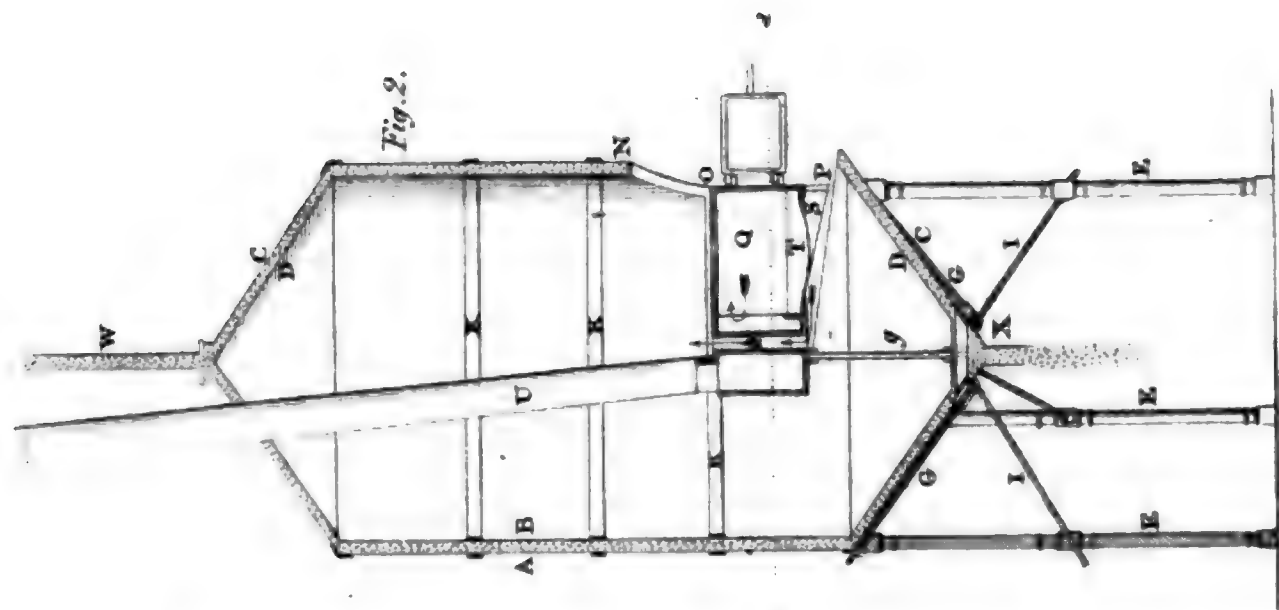
The drawings explanatory of the machine are,

Fig. 1 (Plate XIII.) an elevation.

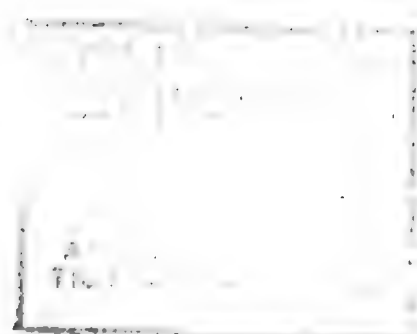
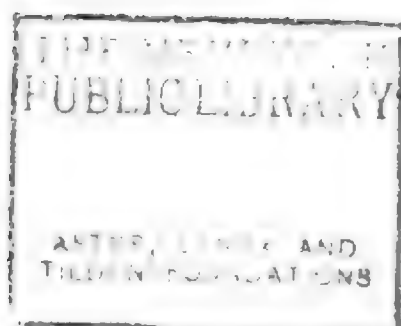
Fig. 2, a vertical section through the line *a b*.

Fig. 3, a horizontal section through the line *c d*, and

Fig. 4, a vertical section of the fire-place on the line *e f*. The same letters indicate the same parts in each figure. The body of the kiln is composed of two concentric cylinders A A and B B, closed at top and bottom by two concentric cones C C and D D; the external cylinder, and the bases of its two cones, are six feet two and a half inches diameter, and eight feet high; the internal cylinder and its two cones are six feet diameter, and seven feet ten inches high; leaving an annular space, one inch and a quarter wide, between the internal and external bodies, which are perforated iron plates, having 2,300 small holes in each square foot. The kiln is supported on five cast-iron columns E, E, E, E, E, six feet six inches high, which are attached at their tops to a strong iron ring which surrounds the base of the cylinder. From the heads of these columns descend along the sides of the cone five long bolts G, G, G, G, G, which are passed through the same number of lugs in the cast-iron ring H, which surrounds the neck of the lower cone; from the same ring H also proceed five stays I, I, I, I, I, which are fastened through the middle of the columns, by a nut on each side. The columns were made of the height here stated, for the purpose of enabling the wheat to be received into sacks, that being the most convenient under the particular circumstances; but in a mill where an elevator is near at hand, or where it would not be inconvenient to allow the wheat to run on the floor, the whole kiln might be brought lower down, and I would
always



10 Feet



always recommend as great a length of cylinder as the height of the granary floor will admit of, as by the grain having a greater distance to descend, the motion would be more rapid, and, consequently, the turning will be more complete. The body is sustained both internally and externally by iron hoops K, K, K, and the distance between the cylinders is preserved by a number of short stays. When the kiln is in operation, the annular space before spoken of is entirely filled with wheat, by means of the spout W, from the granary, which keeps up a constant supply as fast as its exit is allowed at the discharging spout X, the opening of which is governed by a regulator, being adjusted to the time requisite to evaporate the moisture.

In the front of the kiln is cut out a space L, M, N, O, P, in which is fixed the fire-place L, M, O, P, in which Q is the fire-hole, and R, R, are openings with doors, for the purpose of cleaning the flues; S is the ash-hole, and T the fire-bars. On reference to the sections, it will be seen that there are vertical air-passages round which the flame and heat of the fuel circulates to the right and left, until it reaches the chimney, which rises through nearly the centre of the kiln; the course of the flame is evident, by the direction of the arrows, and in its passage to the chimney it very powerfully heats the plates which form the sides of the air-passages, and occasions a constant rush of hot air through them into the body of the kiln. The whole of the fire-place being enclosed within the kiln, it is entirely surrounded (excepting in the front) by a thin shell or casing of grain; and, from its perfect insulated situation, no part of its heat can escape, without having first performed its destined office. The triangular space or opening immediately over the fire-place answers two purposes, the chief of which is, diverting the wheat

as

as it descends, from coming too near the fire, whereby it would be parched; and it affords a convenient entrance into the kiln when requisite. It was at first intended to use a plain open fire-place, with coke or culm, when a chimney would have been unnecessary, and all the heat would be available, which with a chimney is not possible, as of course some heat escapes that way; but it was thought desirable to have a close fire-place, which would produce the required effect with any ordinary fuel, merely by the radiant heat of the iron plates and a current of hot air, without subjecting the wheat to the effluvia arising from the fuel; and I accordingly made it in the way here shown. The front part of the fire-place is supported on the heads of the two front columns, and the hinder part within the kiln by the pillar g, the top of which is fixed in a socket in a bearing-bar across the bottom of the fire-place, and the lower end stands in a cup in the intersection of an iron cross, which rests in the ring H, before-mentioned; and the weight of the fire-place (nearly 15 cwt.) is consequently sustained by the bolts G G, which descend from the heads of all the columns. This weight might perhaps have been reduced, but I would rather make it heavier than lighter; feeling satisfied that the drying must be the more regular, the greater the weight of metal in the fire-place; as from any inattention in the care of the fire, the temperature of the whole mass would be less suddenly affected, either by excess or defect of firing*.

* The height of the fire from the ground renders necessary some convenient means of reaching it, for which purpose a platform is raised about four feet six inches, supported on brackets which are bolted on to the two front columns: and on this platform the man stands to attend the fire; which, if (as I have elsewhere observed) the whole kiln is brought lower down, would be unnecessary.

From

From this description, together with the drawing, the construction will be easily understood; and few words will be requisite to explain its operation. The fire having been lighted, the wheat is admitted from the granary, the regulator at bottom being for a few minutes kept shut; when the annular space being full, the only way the warm air contained in the upper part of the kiln can escape, is through the holes in the iron and the interstices between the grains; and as the stratum or shell of wheat is so thin, the passage of air is very rapid, and consequently the moisture is taken up by it, and carried off with the utmost celerity. With regard to the motion or stirring it undergoes, a few words may be requisite. It is obvious that the apex of the cone (where the wheat enters) must have the greatest heat; here it is in a state of constant diverging motion, rapid where the heat is greatest, and progressively slower as the temperature diminishes, until it reaches the cylinders, where the motion becomes equable. Here the wheat would perhaps descend bodily (particularly if the kiln was made of wove-wire, as at first intended), but the roughness left by the punching of the holes in the iron-plate, is highly useful, as the little resistance it offers to the grain sliding down produces a constant, slow, rolling intestine motion, whereby every individual grain is exposed to the same degree of temperature; it then again converges in the lower cone, producing the same turning and mixing motion, as in the upper cone, and ultimately escapes through the spout at the bottom, either into sacks, or on the ground, as may be desired. It will be perceived that evaporation is at first strongly excited by as considerable a degree of heat as the purpose will safely admit of, which evaporation is then gently kept up by a progressively decreasing temperature, as the grain descends towards the discharging

VOL. XLIV.—SECOND SERIES. O o spout;

spout; and it will be obvious that the grain need not be subjected to the same degree of heat during the whole time it is in the kiln, if we reflect that in each individual grain, the surface is very speedily dried by the elevated temperature of the air it is at first exposed to; and then the superficial particles abstract the moisture from the internal ones with considerable avidity. The external ones being already sufficiently warmed, give out this acquired moisture in the form of vapour, which is eagerly taken up by the passing current of warm air, the miscibility of which with water is increased by its increased temperature; and I am certain that a greater degree of heat may safely be applied while the grain is constantly turned, than could possibly be allowed if it lay at rest, whereby the part immediately exposed would inevitably be overdried. It may also be mentioned that during the time the kiln is at work, the operation of screening is to a certain extent constantly going on, by which much of the dust, seed, insects, and other extraneous matters are separated; and it is well known that grain cannot be too well screened from all impurities previous to storing, as its perfect preservation depends much on that circumstance. The rapidity of its operation is such, that when it was tried on two different days before I left it, the grain flowed from it, perfectly dried, four bushels and a half, in five minutes and a half, being at the rate of 29 load, or 145 quarters *per* day; which can only be accounted for by the circumstance of the aqueous vapour being carried clear away at once, without any part of it being deposited on other grains, and from the great quantity and rapidity of the current of warm air which constantly passes between the grains, taking up the humidity as quick as it is converted into vapour; for the temperature within the kiln, as far as I could reach to hold the thermometer,

thermometer, did not exceed 94° ; and indeed I scarcely know how I can show the imperfections and inferiority of the ordinary system plainer, than by saying that the grain (under an average state) does not require to remain in the new kiln longer than half an hour, while the same wheat will not be dried on the old kiln in less than seven hours and a half. Thus the advantages, when compared with the common mill-kiln, will be seen to be these—the horizontal space it occupies is not more than one-thirtieth of that which would be occupied by the ordinary kilns capable of performing the same quantity of work; it saves all the labour of the scoop required in charging, turning, and discharging the common kiln; the wheat is kept in a constantly uninterrupted state of turning, infinitely superior to that by the agency of the scoop, as not even a single grain can remain at rest; the comparative consumption of fuel is much lessened, being about half a bushel *per* load, and common coal is more suitable for the purpose than culm, which gives less flame, and is more expensive; it is dried with perfect equality, and, above all, the quantity it will dry is six or seven times as great as by the common method; for the kiln which was removed to make room for the new one, dried (as before stated), on the average, fourteen quarters and a half *per* day, and it will be seen by the accompanying certificate, that the medium quantity is 95 quarters; then, as $95 : 14.5 :: 6.5 : 1$. Or, if we take the quantities before-mentioned, the proportion will be as ten to one. For as $145 : 14.5 :: 10 : 1$. This to the corn-merchant is an advantage of much importance; as frequently, on sudden changes of the markets, it is desirable to ship the grain with the utmost dispatch, but the shipment is often much delayed by the necessity of kiln-drying the cargo
previous

previous to loading the vessels ; by which delay, arising from the tardiness of the common operation, the advantages of a good market are not unfrequently lost.

I have in the outset noticed the occasional necessity that farmers are under of drying their crops of corn, peas, beans, &c.; and for the use of the farmer only, this kiln may be made of less size, unless in very large establishments, but it is on a large scale that the advantages will be best shown ; neither does the expense increase directly as the dimensions. The application of the principle here used to the purposes of malting, is easy and evident ; but considerable modification in the detail would be requisite, as the germination of the radicle would prevent that kind of semi-fluidity of motion which simple granular substances are susceptible of.

Thus having stated all that appears to me requisite to render the thing clearly understood, I beg to repeat that my perfect conviction of its usefulness and importance in the preservation and preparation of one of the most valuable and indispensable articles of human sustenance, is my inducement to submit it to the Society's consideration, and if any further information is required, I shall feel happy to give it in person.

CERTIFICATE.

Bedhampton, near Havant, Hunts,
April 30, 1823.

This is to certify, that Mr. J. Jones, of High Holborn, did, in July 1822, erect for me a kiln for drying wheat, on an entirely new construction ; that it occupies very little space ; it saves the labour of the scoop in charging, turning, and discharging, as in the common kiln ; the
grain

grain is kept constantly in slow motion, whereby the drying is more equal, and it will dry from 60 to 120 quarters in 24 hours.

JOHN SNOOK.

A further certificate to the same effect as the preceding, has been received from E. F. Hawes, Esq., of Crowborough Lodge, East Grinstead, for whom Mr. Jones has constructed a kiln.

On an early Variety of Horse Bean.

By W. PYLE TAUNTON, Esq. of Cheam.

From the TRANSACTIONS of the SOCIETY for the ENCOURAGEMENT of ARTS, MANUFACTURES, and COMMERCE.

The large Silver Medal was given to Mr. TAUNTON for this Communication.

PERCEIVING that you have offered a premium for the cultivation of any species of beans which shall be cleared off the ground, ripe, before the middle of August, I take the liberty to submit to your consideration my humble pretensions as a claimant of that premium, in respect of the cultivation of the winter-bean; a variety which I have not met with in England, in the hands of any other agriculturist, nor can I inform you of what country it is a native. I derive my stock from so small a quantity as a pint communicated to me by a friend on the Continent about six years back; from which small beginning I have gradually extended my stock until I could make this variety the subject of field culture. Its properties are, that it is a small, firm, plump, and heavy seed; that the plant is very productive and very hardy; that it ought to be sown in autumn, and that it admits a very considerable latitude in the time of sowing, inas-
much

much as I have had the finest of produce from the ripened seed which has shed itself in July, and have also had it succeed well, though sown late in November; but the time of sowing to which I should give the preference is, the month of October; that if the land be properly relieved from stagnant water, the young plants bid defiance to all the frosts of winter, even in the coldest and wettest clays; and that if, as I have sometimes seen it happen, after the bean has renewed its growth in Spring, and made considerable progress in fresh vegetation, a severe honeycomb frost, attended with alternate thaws, cuts its tender shoots, the plant indemnifies the farmer, by tillering out with increased vigour from the roots, which I have never known to be affected by the vicissitudes of the weather. Indeed, in all circumstances, this variety tillers out very freely; insomuch that in 1821, when I had drilled only seven gallons of seed on five roods of ground (which is only after the rate of five and a half gallons to the acre) at intervals of eighteen inches between the drills, I found that the plants were thicker than was consistent with a full crop of grain. They are very prolific, and I have always had abundant reason to be satisfied with their produce, until the present year; but the extraordinary mildness of the last Winter having caused all the beans which I had sown in September to blossom in March, and the beginning of April, some cold weather, which subsequently ensued, prevented the earlier blossoms from setting, and caused a considerable degree of blight, which I had never before experienced; and a small quantity of ground, not exceeding thirty-one rods, which I sowed during the month of November, proved much more productive than any of those which I had sown earlier. I have, in every instance hitherto, in the climate of Surrey, where alone I have tried these beans,

beans, had them all harvested before the last day of July, and the seed has always then been hard, dry, and bright.

A bean possessing these qualities appears to promise the following important advantages to the cultivator : in a season when beans are scarce, it may be thrown into the market in the end of July, or beginning of August ; and inasmuch as it greatly resembles an old bean in its hardness and dryness, it may reasonably be expected to obtain a price nearly approaching to the price of old beans. No competition can at that time be apprehended from new beans of the varieties usually sown, for they are at that time still growing and in an unripe state. Next, the Winter bean being ripened in the heat of Summer, yields to the flail as soon as it is carried from the field ; whereas the later varieties, coming to maturity only under the weaker and more uncertain suns of Autumn, require to be kept longer in the stack or barn to dry, before they will readily thresh. The farmer, therefore, can convert the produce of this variety to money, on an average three months earlier in the year than he can the produce of the ordinary sorts. Next, the weight, plumpness, and hardness of the sample, will at all times recommend it, and ensure a superior price. But the greatest advantage which it offers to the agriculturist, above all, in those rich soils which permit the long-continued alternation of wheat and beans, such as the vale of Pewsey, the vale of Evesham, and other highly-favoured districts, is this, that after this bean-crop is harvested, there still remains enough of the heat of Summer, to give to the land which has borne it a very effective fallow before the season requires the succeeding crop of wheat to be sown. If, in 1818, or in 1822, the plough had been put into the foulest and wettest ground, on the 20th of July,

July, at which time my beans were cleared, or even within a month after that time, there was sufficient subsequent heat and drought to have roasted and killed every weed, and to have so completely dried and contracted the toughest clay, that upon the first succeeding rains it should all have shivered into the finest tilth, perfectly clean, and ready to receive wheat, or any other seed, whereas, in the ordinary course of bean-culture, the beans often are scarcely got off in time to plough for wheat; and the land is then frequently so foul as to be unfit for any crop at all, without an intervening fallow.

I have found this crop well adapted for sowing therewith the seeds of perennial grasses for permanent meadow. I feel called upon to make a remark on the quantity of land which I have this year sown with these beans, and which I humbly conceive ought to be considered as amounting to the extent (five acres) which the Society has required. The largest of the fields, called Claypon-field (ten acres, one rood, and twenty perches), which was actually sown with them, at intervals of twelve feet between drill and drill, will not, probably, be considered by the Society as a space of ten acres fairly cropped with beans; but it may with propriety be considered, that an interval of three feet between the rows is a proper and husbandlike distance for the cultivation of beans, especially since the crop sown at eighteen inches was found to be too closely sown; and if this be allowed, then the same number of rows of beans which were spread over ten acres, one rood, twenty perches, at twelve feet interval, will, at an interval of three feet, cover two acres, two roods, fifteen perches.

Let

	a.	r.	p.
Let Claypond field, therefore, be considered as	2	2	15
In West-London-lane field the beans were	1	1	26
In Ruffett field the beans were	1	1	0
In Peach's close I had of these beans	0	0	31

And the total area of the beans will be 5 1 32
thus exceeding the quantity which the Society requires.

With respect to the expense of the culture of the winter beans, my answer must, to a certain degree, be hypothetical; because, in the year in which the crop grew whereof I have sent you a sample, the beans were not my primary object; but my primary object was, the reducing of a stiff, sour, clay land to permanent meadow (a subject to which I have given many years attention, with the most satisfactory results), and I only combined the beans with that object, because I wished to increase and propagate the beans, and had no other ground ready to take them. The course of crops in Claypond field (where the beans stood at twelve feet interval between the rows, for the several preceding years) since I first occupied the land was—

Harvest 1819.—Wheat; dunged for

Harvest 1820.—Tares, fed off with sheep, intended to be sown to grass in August, but the showery weather prevented my getting the land fine enough for grass that year; wherefore, I again sowed for

Harvest 1821.—Tares, fed off with sheep; and in September, 1821, sowed it with grass and beans at twelve feet interval, thinking to steal from the grass a crop of beans, which, at this wide interval, would not hurt the grass. I am of opinion that the excess of manure in this field, which would have been beneficial to the grass,

assisted to force the growth of the beans prematurely, and also to prevent their maturing their seed, and to render them more obnoxious to the blight. As I had high narrow ridges of old arable to level in this as well as in all my fields, before I could bring them into a fit state for a meadow, I ploughed, in the Summer of 1820, six or seven times, to level the ridges, and in Summer 1821, I ploughed about three or four times; viz. half the ground three times, half four times, besides many harrowings: my object being to produce for the grass as fine a tilth as possible (which is indispensable for the purpose of creating meadows in the best manner); but for the beans only, had they been my principal object, I would not have given more than a single ploughing, and much less manure. The committee will observe, that the beans in Ruffett field were the very worst of my whole crop.

The piece of land in West-London-lane field, which bore beans, was thus cropped:—

Summer 1819.—An imperfect Summer fallow, I not having time to spare to it from other objects.

Spring 1820.—Cales; viz. chou cavalier, chou caulet de Flandres, chou moëllier, and chou mille-têtes, mixed, in drills, at two feet four inches: dunged for

Harvest 1821.—The same (after being cut for sheep in the Spring, and carted to a distant meadow) stood for seed, and produced a crop.

1822.—The same (having been once or twice ploughed between the drills in the Autumn and Winter) were fed off by sheep in the Spring; their gnawing of the bark of the stalks killed many plants; the others stood and perfected a second crop of seed in Summer 1822; after which, about three or four ploughings were given to level the ridges, with a view of sowing grass thereon; and cocksfoot (*dactylis glomerata*) was accordingly sown in
September,

September, 1822, as soon as the beans had been sown and harrowed in. It will be observed, that no manure was applied to this, except the original dunging for the cabbages in Spring 1820, and the droppings of the sheep in April 1822, which may be conceived to be nearly counterbalanced by the scourge of a crop of cabbage carted off, and two crops of cabbage-seed, so that no particular indulgence in point of manure can be said to have been shown to this crop; and this crop the Society will be pleased to remember, was better than that in Ruffett field, but still was a bad crop, being too early, and thereby blighted, and also being a good deal shaded by hedge-row timber. Had it been my object to sow beans only, I certainly should have given only one ploughing for them.

The land in Ruffett field was thus managed :—

Harvest 1819.—An imperfect Summer fallow.

Harvest 1820.—Scarlet-robe potatoes, with dung.

Harvest 1821.—The ridges ploughed down, and levelled by three ploughings and five harrowings, and sown in September with beans and cocksfoot grass.

This cocksfoot proved an excellent plant, and is now as good a piece of perfectly clean cocksfoot as any within fifty miles of London, the ground having been sufficiently fine when it was sowed.

The committee will perceive, that the circumstance of sowing grass with the beans entirely precluded hoeing in all of these instances, and that the produce might have been reasonably expected to be more advantageous, if hoeing had been performed.

TO BE CONTINUED.

Description

Description of a New Reflecting Telescope. By DAVID
BREWSTER, LL.D. F.R.S. L. and Sec. R. S. Edin.

With an Engraving.

From the EDINBURGH PHILOSOPHICAL JOURNAL.

THE only improvements on the reflecting telescope which have been proposed during the last century, are those of Lemaire and M. Burckhardt. The first of these authors suggested the idea of employing what is called the *front view* in Newtonian telescopes of a large size; and this method was found of great value in the magnificent instruments of Sir William Herschel. In this case, the small speculum was laid aside; and the observer, placed with his back to the object, looked through an eye-piece placed on one side of the mouth of the tube, while the rays issuing from the object entered at the other side. By this means a second reflexion was avoided; and though a slight distortion in the image must have resulted from the obliquity of the first reflexion, yet the inclination of the incident and the reflected rays was too small to produce any perceptible error.

In order to shorten the reflecting telescope, M. Burckhardt, of the Academy of Sciences, proposed to substitute a plane speculum in place of the small concave speculum of the Gregorian telescope. By giving the plane speculum *half* the diameter of the large one, and placing it *half-way* between the large speculum and its principal focus; it intercepted the cones of rays at the middle of their axis, and reflected them to foci within the perforation of the great speculum. In extending this principle to the Newtonian telescope, M. Burckhardt proposed that the plane speculum (of the same size, and similarly placed,

as

as in the preceding construction) should be inclined to the reflected rays, so as to throw the image above the great speculum, where it is viewed by the eye-glass.

The disadvantages of these constructions are very obvious, and are by no means compensated by the trivial advantage of shortening the telescope. The difficulty of giving a good figure to a plane speculum one-half the diameter of the large one, the loss of light by a perpendicular reflexion, and the circumstance of the plane speculum intercepting such a large portion of the incident rays, will prevent this construction from being carried into effect.

Mr. Paterson had previously constructed a Newtonian telescope upon the very same principle as that of M. Burckhardt, but with this difference, that the plane speculum was placed at one side, so as not to intercept any of the incident rays, and consequently the great speculum inclined to the incident rays. This, however, cannot be considered as an improvement; for though it removes the objection arising from the loss of light, it introduces the much greater evil of an oblique reflexion, and consequently a distorted image. In telescopes of five feet focal length, and an aperture of seven and a half inches, the inclination of the incident and reflected measures is about *eleven degrees*.

We believe it will be admitted by every person who has had much experience in the use of reflecting telescopes, that the Newtonian form is decidedly the best. Its construction is so simple, and it is so little liable to derangement from accidental causes, that for popular use, on a small scale, it is superior to the Gregorian one; while, for instruments of great size, it is the only form that is practicable. But even when we consider it in a scientific point of view, it has the advantage of the Gregorian

gorian form. It is more easy to give a perfect figure to an uniform circular piece of metal than to a perforated disc; the spherical aberration is less, in so far as it is not increased by a second spherical mirror; and the quantity of light reflected from the oblique small speculum is decidedly greater than when it is reflected at a vertical incidence.

If we could dispense with the use of the small specula in telescopes of moderate length, by inclining the great speculum, and using an oblique, and, consequently, a distorted reflexion, as proposed first by Le Maire, we should consider the Newtonian telescope as perfect; and on a large scale, or when the instrument exceeds twenty feet, it has undoubtedly this character, as nothing can be more simple than to magnify by a single eye-glass the image formed by a single speculum.

As the *front view* is quite impracticable, and indeed has never been attempted in instruments of a small size, it becomes of great consequence, in a practical point of view, to remove as much as possible the evils which arise from the use of a small speculum. These evils may be thus enumerated.

1. If we suppose the light reflected by the large speculum; or the light incident upon the small one, to amount to 10,000 rays, then the light reflected by a well polished plane speculum will not exceed two-thirds of this, or 6666 rays, at a vertical incidence, and probably not above 6900 at an incidence of 45° *; consequently 3200 rays out of 10,000 are lost by the use of the plane speculum.

2. Besides this great loss of light, we have to encounter all the errors of a second reflexion, arising from imperfections of surface, and also from imperfections of

* The law of variation is yet undetermined.

figure,

figure, as it is universally admitted that a surface of glass is much superior to a metallic surface; and Newton has himself remarked, "That every irregularity in a reflecting superficies, makes the rays stray *five or six times* more out of their due course than the like irregularities in a refracting one."

The deviation of a ray arising from the imperfections of a reflecting surface is to the deviation arising from the imperfections of a refracting surface as *four to one*, when the refraction is made from glass into air; and as *six to one* when the refraction is made from air to glass.

The construction by which I propose to remedy these disadvantages is shewn in Fig. 5 (Plate XIII.), where AB is the speculum reflecting the parallel rays RA, RB, to a focus at F. The cone of rays A, F, B, is intercepted by an *achromatic prism* GH, which refracts them to foci at *f*, where a distinct image is formed in the anterior focus of the eye-glass E, by which it is magnified. The compound prism GH being composed of a prism of crown-glass G, and a prism of flint-glass H, united by a cement of a mean refractive power, the loss of light sustained by the pencil in its transmission through the two, will not exceed 600 rays of the 10,000; as the light transmitted through a lens of glass is, according to Sir William Herschell's experiments, 94850 out of the 10,000 incident rays. Hence the light lost by transmission through the prism, is not *one-fifth* part of the light lost by reflection, and the errors of reflection, arising from defects of surface and of figure, are also incomparably less. As the refracting angle of the prism G will require to be larger, in order to produce a given deviation F, H, *f*, when it is opposed by the refraction of the flint-glass prism H, we may place the correcting prism H nearer the focus *f*, as shewn in Fig. 6, and make it of crown-glass; or it might even

even be placed at *h*, beyond the focus, and in contact with the lens E. If this should be found advantageous, the prism and the lens might be formed out of one piece of glass, or a single hemisphere of glass might be used, the eye-hole being placed at such a point of the hemispherical surface, as to obtain a variable prism of the required angle united with a plano-convex lens.

Every plano-convex lens, or plano-concave lens, may be converted into a lens and a prism combined, by shifting the eye-hole from the vertex of the lens to one side.

As Dr. Maskelyne found that the Greenwich Newtonian telescope was greatly improved by inclining the speculum, or rather its axis, about two and a half degrees to the axis of the tube, it follows, that it performed best with oblique pencils in a certain direction. Before fitting up this telescope, therefore, or indeed any Newtonian telescope, it should be ascertained, by turning the speculum in its cell, and giving its axis various degrees of obliquity, whether or not its performance is improved. If this is found to be the case, and that the angle of inclination is, for example, two and a half degrees, we shall then require a less angle in the prism G, as part of the deviation of the pencil to the side of the tube is already produced by the new position of the axis of the speculum.

It is obvious, that any rays incident on the prism G H, parallel to the tube, will be refracted upon the side of the tube, and will have no effect upon the image; but if they should be thought injurious, we have only to place an opaque screen, of the same size as G H and its arm, somewhere between G H and the mouth of the tube, so as not to interfere with the cone of refracted rays G, H, *f*.

This

This form of the reflecting telescope enables us to construct a very simple double image micrometer, the prism H, either when united with G, as in Fig. 5, or when separated as in Fig. 6, being made of a doubly refracting crystal, cut in such a manner as both to correct the colour of G, and produce the two images.

In viewing eclipses of the sun, or the lunar disc, or any other celestial phenomenon, where there is either too much light, or more than is necessary, a telescope may be fitted up to permit more than one person to see through it at the same time, by allowing a portion of the cone of rays to be refracted through another prism to an eyeglass at the opposite side of the tube, or even by having four prisms refracting a fourth part of the cone to each of the four sides of the tube. The same effect might be produced in the common Newtonian telescope, by using a pyramidal small speculum, with the planes meeting at a vertex placed in the centre of the cone of rays, and inclined to one another at angles of 90° , and to the axis of the telescope at angles of 45° . Another person at A might also be made to see the eclipse by means of a parallel plate of glass at $m n$, inclined so as to reflect a portion of the cone of rays to A. In this way five persons might see through the telescope at the same instant.

Description of a New Reflecting Microscope. By DAVID BREWSTER, LL. D. F.R.S. Lond. and Sec. R. S. Edin.

With an Engraving.

From the EDINBURGH PHILOSOPHICAL JOURNAL.

THE various forms which have been given to the reflecting microscope, are necessarily derivable from those which have been given to the reflecting telescope; and

the one instrument is nothing more than the other, either inverted or modified, for the examination of near objects.

The reflecting microscope of Dr. Barker is the Gregorian telescope lengthened so as to permit it to act as a microscope. The reflecting microscope of Dr. Smith is the Cassegrainian telescope, with this difference only, that the convex mirror is perforated to allow the rays of the object to pass through it, whereas, in the telescope, the rays pass without the convex mirror.

A microscope will perform very well, when it is made exactly like the Cassegrainian telescope.

The microscope of Professor Amici, of Modena, is also an inversion of the Newtonian telescope; and the reflecting microscope which I have proposed in the article microscope, of the Edinburgh Encyclopædia, is the Cassegrainian telescope in an inverted form. In like manner, the microscope which I intend now to describe, is an inverted form of the reflecting telescope, described in the preceding article.

This microscope is represented in Fig. 7 (Plate XIII.) where A, B, C, D is a tube supported horizontally, upon a stand S T, with a draw tube E containing an eye-glass. An ellipsoidal speculum A B, having its two foci at F, *f*, is placed at the other end of the tube, and an *achromatic prism* G H, constructed in the manner described in the preceding article, is placed between the mirror A B, and its nearest focus F. An arm K L, projecting from the stand S T, carries at its end K an inclined ring, for holding the object sliders, and the object, such as *m n*, may be illuminated either in front, if it is opaque, or by a mirror below, if it is transparent.

When the distance of the object *m n*, from the prism G H, is equal to the distance of the prism from F, the refraction, by the prism, of the rays proceeding from
the

the object *a b*, will make them fall upon the speculum A B, as if they had proceeded from F, and a magnified image of it will be formed in the other focus *f*, which will be again magnified by the lens or lenses placed at E.

The advantages of this microscope may be estimated in exactly the same manner as has been already done, when we described the analogous combination in the form of a telescope. The prevention of the loss of light by reflection from the second speculum is the chief advantage of this construction, and has been already fully explained,

When reflecting microscopes are constructed on a very large scale, as recommended in a former article*, the small speculum, or the glass prism, may be entirely dispensed with, and the whole effect may be produced by oblique vision, as in the large telescopes of Sir William Herschel.

Instructions for Packing living Plants in Foreign Countries, especially within the Tropics; and Directions for their Treatment during the Voyage to Europe.

By Mr. JOHN LINDLEY, F. L. S. &c.

FROM THE TRANSACTIONS OF THE LONDON
HORTICULTURAL SOCIETY.

THE importation of plants from foreign countries has now become an object of such great importance, not only to the Society itself, but to a large portion of its Members, that *directions for preparing collections for their voyage hither*, are become absolutely indispensable. For it is an undoubted fact, that a very considerable part of the losses continually sustained by collectors, especially among plants sent from China and the East-Indies, are

* Edin. Phil. Journal, vol. VI. p. 105.

in a great measure to be attributed to the insufficient manner in which the packages were originally made up. This having been particularly the case with many fine collections sent to the Society in the course of the present year, my attention has necessarily been directed strongly to the subject; and as it is probable that instructions published through the medium of the Society, will be more likely to remedy the evil than any given in a separate form, I now beg to submit the following suggestions to consideration.

The insecure modes of packing plants abroad do not, of course, arise from any indisposition on the part of those who prepare them to give them all necessary care, nor from any indifference as to their fate; but entirely from not considering sufficiently the various accidents to which plants on ship-board are exposed, and the improbability that they will experience, even under the most favourable circumstances, that care and attention which they require. In vain are lives and property risked in attempting to transfer the vegetable beauties of other countries to this, if the same pains which were devoted to procuring them be not continued in their subsequent management. The idea which seems to exist, that to tear a plant from its native soil, to plant it in fresh earth, to fasten it in a wooden case, and to put it on board a vessel under the care of some officer, is sufficient, is of all others the most erroneous, and has led to the most ruinous consequences.

Perhaps, beyond any thing else, it is necessary to take care that before plants are finally prepared for their voyage, their roots be well established in the pots, in which it is intended they should be transported. With many herbaceous plants this requires only a short space of time; but for such as are shrubby, or of a hard woody texture,

texture, a period, in many instances, of not less than two or three months is absolutely necessary. The attention of gentlemen residing in hot countries, particularly within the tropics, cannot be directed too strongly to this fact, which if alone neglected, must either destroy entirely, or very materially weaken, the effect of any attention which may be otherwise bestowed.

I would recommend that square wooden boxes be used for the plants instead of earthenware pots, not only because the former are less liable to be broken, but also because they are lighter. When the period for embarking them arrives, they should be placed in wooden cases, the tops of which must be capable of being opened, and should slope both ways like the roof of a double greenhouse. These cases must be furnished with a tarpawling, fixed along their tops, and sufficiently large, when unrolled, to cover them completely, so as to protect the plants from being damaged by the salt-water dashing over them in rough weather.

It cannot be expected that heavy cases should meet with very gentle treatment on ship-board, and it is certain they will be handled in the roughest manner by watermen, carters, and custom-house officers, after they have arrived in port. The materials therefore, of which they are made, ought to be of a very strong description, and the joints of the lower part either secured by iron bands, or well dove-tailed together; but as the former method is attended with less trouble, and is equally secure, it will probably be the more generally adopted. Instances are not uncommon of fine collections being delivered from the custom-house, with the sides of the cases beaten in, and the plants and pots broken in pieces.

The person in charge of the cases on board should have directions never to exclude them from air and light
in

in fine weather, unless to protect them from the cold, as the vessel makes the land, and after she is in port, or during high winds, or especially when the seamen are washing the decks; but in foul weather to close the lids down, and to unroll the tarpawling over the latter, so as to exclude the sea spray effectually. If, notwithstanding these precautions, saline particles should become encrusted upon the leaves and stems of the plants, it is necessary that the former should be removed as soon and as carefully as possible, with fresh water, and a sponge, otherwise the salt soon kills them. The quantity of water the plants receive must be determined by what can be spared; so that no other direction for its application can be given, than to keep the mould just moist. The requisite supply of water must also depend much upon the way in which the cases are drained. The best manner in which this can be effected, is by causing holes about half an inch in diameter to be bored through the bottom of the cases and pots. Much mischief being occasionally done to collections by monkeys and parraquets on board the vessels, it is highly necessary that means should be taken to guard against their attacks.

Collections are not unfrequently injured after they arrive in this country, by the pots being shaken so violently as to be deprived of a large portion of their mould. Nothing can well be more destructive of vegetable life than this, which should be prevented by the pots being made square, so as to fit accurately into the bottom of the outer case. There then could be no difficulty in keeping them steady; and if they were fastened down by cross pieces of wood, they would be secured still more completely. In addition, the surface of the mould ought to be covered deeply with coarse moss, or other similar substance (not grass), which might be secured by
packthread

packthread passed frequently across the box from its sides; or by slender laths, which would be less likely to become rotten than packthread. By this means evaporation of the watery particles which are necessary to the existence of the plants, proceeds much less rapidly than when the mould is exposed; and the latter has an additional security against being shaken out of the pots.

When it happens that pots are not to be procured, the want of them must be supplied by the collection being planted in earth in the cases themselves, their bottom being previously strewed to the depth of an inch or two with fragments of earthenware, or bits of wood. In such cases it is particularly necessary that the mould should be securely fastened down.

Parasitical orchideæ, or, as they are commonly called *air plants*, may be transported safely to any distance by being packed loosely in moss, and put into boxes, so constructed that the plants may be exposed to a free admission of air, but protected from the sea-water. So managed, with a moderate supply of water, the most delicate of them might probably be transported to any distance without difficulty. But if, as is generally the case, they are packed closely in moss, in boxes insufficiently ventilated, they will inevitably become heated and perish. It has occurred to me that the best method of sending them would be in boxes made of trellis work, and provided with cross pieces of wood in their inside, to which the plants with the bark or moss on which they grew might be securely tied, and the interstices filled loosely with moss. The lid of such cases might be nailed down, and no other subsequent care would be necessary than a gentle occasional watering and protection from sea-spray. Or they might, perhaps, be transported safely by the still more simple plan of placing them in closed boxes, they

they being first carefully separated with the rough branches of the trees on which they grow. For the chief point is to keep them from heating; and that could scarcely occur if the branches or intervening substance were so disposed as to prevent their leaves touching each other.

Bulbs travel most securely if they are packed in paper or canvas bags, they having been previously dried till all the moisture in their outer coats is evaporated. Dry sand is a good medium for placing them in, if opportunities should not have occurred of giving them the necessary exposure to the sun. But minute bulbs, such as those of *ixias*, *gladioluses*, *oxalises*, and others of a similar kind, only require to be folded in separate little parcels without any previous preparation. *Terrestrial orchideæ* should be transplanted when in flower, and not when their roots are in a state of rest.

Among the mould in which plants are potted, it is very desirable that any woody or bony seeds, or capsules, that may have been procured should be buried; or any of those seeds, the juices of which become rancid soon after gathering, such as those of *guttifera*, *magnoliacæ*, *sterculiacæ*, &c.; *camellia* seeds, which are not readily transported, if sown in mould in China, will have become seedling plants before they reach this country. *Acorns* and *walnuts* may be conveyed from hot countries much better in this way than in any other: packed thus, we may some day expect to receive from China plants of *quercus cornea* of *Linnaeus*; which I may observe is a species of *hickory*. The plants of the rare and curious *butter and tallow tree* of Sierra Leonê, which have been raised in the Society's garden from seeds collected by Mr. George Don, in the present year, are nearly all of them the produce of capsules sent home in moss or in mould.

mould. Of the many packets received in a dry state, in paper, scarcely any could be made to vegetate. *Palms* too are better sent in this way than in bags or paper.

The plants in all cases, if possible, should have numbers punched upon small pieces of thin sheet lead, and fastened round the subjects to which they belong with fine iron or copper wire. When such lead is not to be procured, little wooden tallies, should be used instead; always, however, tied round the stem or a branch of the plant, and never stuck into the mould in which it is planted. Paper or parchment tickets ought on no account to be used. Corresponding with these numbers, lists should be prepared in which the names, localities, principal features of the plants, and particularly the elevation above the sea at which they were collected, should be fully stated; their vernacular names ought, moreover, to be ascertained, when they have any.

Among the cases received by the Society this year from its numerous contributors, were four transmitted by his Excellency Sir Robert Farquhar, from the Mauritius. They were a kind of portable green-house, constructed in a very superior manner to any I have seen elsewhere. It is therefore presumed that an accurate plan and description of them, with such slight alterations as have appeared to be requisite, cannot be otherwise than acceptable. The plants they contained arrived in this country in much better condition than any received by the Society in the same year.

DESCRIPTION of the BOXES.

They were made of stout inch board well fastened together. Their height was three feet, length four feet, breadth one foot eight inches. Twenty inches from the bottom they sloped off like a penthouse, till the top was

not more than two inches and a half wide. The sloping part on each side was closed by a shutter, formed of wooden bars two inches wide and two inches asunder, connected by a cross-rail at their ends. To the inside of these, panes of stout coarse glass were fixed by means of narrow slips of tin fastened to the centre of the bars where necessary, and well puttied in. The shutters were moveable by means of hinges on their lower side, and in fine weather were kept open by hooks fixed within three or four inches of the top, into each side of the end of the boxes, and fitting into a staple in the corresponding edge of the shutter; they were long enough to sustain the shutter, when open, in a perpendicular position. The shutters fell down so as to close the boxes completely in rough weather, and were kept together by two hooks fixed in the upper edge of one shutter, and catching into a corresponding staple in the opposite shutter. A piece of tarpawling was nailed to the top of the boxes, and in rough weather was unrolled and fell down over the sides, so as to protect them from the sea spray. In fine weather, when the shutter was opened, it was rolled up again, and tied together with two pieces of cord, so as not to interfere with the shutters opening and closing. The trees were planted in square wooden boxes, just large enough to contain a single plant, and perforated with holes in their sides and bottom.

On the Cultivation of Horse-Radish.

By Mr. DANIEL JUDD, F. H. S.

From the TRANSACTIONS of the LONDON
HORTICULTURAL SOCIETY.

THE first thing to be provided is a proper spot for the bed; it too often happens that horse-radish, as well as many

many other herbs, is injudiciously placed in some corner of the garden, out of sight, without any attention being paid to the natural habit, or proper treatment of the plant. Although I do not mean to advance that it is necessary to give the first place in the garden to such things, yet it is very desirable that they should have proper situations. The horse-radish in particular should have an open spot of ground, and it requires some little trouble to bring to perfection.

After having fixed on a spot of the garden sufficient for the crop I intend to plant, it is trenched two good spades (I ought rather to say two feet) deep, either with or without manure, according to the state of the soil, which, if in itself good, requires no enriching; but if it is poor, some good light manure ought to be added to it, and this must be carefully laid into the bottom of each trench, for, if not so done, the horse-radish, which always puts out some side roots, would send out such large shoots from the main root in search of the dung contiguous to its sides, as to materially deteriorate the crop.

After the bed is thus prepared, plants are procured by taking about three inches in length of the top part of each stick, and then cutting clean off about a quarter of an inch of this piece under the crown, so as to leave no appearance of a green bud. Holes are then made in the bed, eighteen inches apart every way, and sixteen or eighteen inches deep; the root-cuttings, prepared as directed, are let down to the bottom of the holes, which are afterwards filled up with fine sifted cinder-dust, and the surface of the bed is raked over as is usual with other crops; it will be some time before the plants appear, and the operation of weeding must be done with the hand, and not with the hoe, till the crop can be fairly seen; afterwards nothing more is requisite, beyond the usual work

work of keeping clean, till the taking up of the crop, and this may be done at any time during the winter months.

The distance at which I have always planted my horse-radish, has been eighteen inches every way, but I think, on very good land, that the rows should be two feet, and the plants eighteen inches in the rows apart; in some soils the plants grow more to leaf than in others, consequently, they should in such situations have more room allowed for their growth.

My time of planting is between the middle of February and the middle of March; I always find that the stouter the cutting the better will be the produce; no make-shift roots will do well, neither can careless planting be allowed; if due attention to these essential points is not given, I cannot promise a good crop.

The instrument used for making the holes is like a potato-dibber, about an inch and a half in diameter near the point, and two inches and a half at the upper part, so that the top of the hole it makes is larger than the bottom.

On a Method of raising Early Cucumbers.

By RICHARD VACHELL, Esq. F. H. S.

From the TRANSACTIONS of the LONDON
HORTICULTURAL SOCIETY.

MY gardener, John Furrell, having succeeded so well this season in raising *early cucumbers* by an easy method, which I have not before seen practised, I herewith send you an account of his plan.

Instead of a bed of dung, put together in the usual manner, he formed a bed of faggots four feet high, laid as even at the top as the wood would admit of, and round the

the faggots he drove stakes to prevent them from slipping; on the bed thus formed he placed some straw and long litter, then fixed the frame. Over the straw some old tan, which had been used in the pine-pit, was spread, in order to prevent any steam rising through the bed, and on the tan he placed the mould in which he set his plants. The bed was surrounded by linings of hot dung nearly to the height of the lights, and these were removed as often as the declining heat required.

Under this method cucumbers were cut on the 22d of February, and I have been constantly well supplied with them ever since. I consider this plan much superior to the hollow brick-work recommended by Macphail.

Observations on the Effect of incomplete Calcination of common Limestone. By M. VICAT.

From the *ANNALES DE CHIMIE ET DE PHYSIQUE*.

IN a letter addressed by M. Clement to the President of the Academy of Sciences (*Annales*, Sept. 1829), Mr. Minard, engineer of the establishment *des Ponts et Chaussées*, appears to have discovered by numerous experiments, that all calcareous stones, when slightly calcined, will produce Roman cement. I have mentioned (*Annales de Chimie*, t. 83) that powdered chalk heated from six to thirty minutes on a red-hot iron plate, acquired the singular property of setting in water, when it is slacked stiff like plaster of Paris. As chalk is considered as the most perfect specimen of fat lime, and the purest calcareous earth that is employed, I might have generalised my conclusions, and inferred that all other fat limes had the same property; but the numerous exceptions that I have met with in my experiments, have made me cau-
tious

tious of admitting general rules, a caution which will be justified by the following observations.

It is now four months since my specimens of chalk-lime have been kept under water, in a room of which the temperature never falls below 48° Fahr.; they are still in the same state as they were after the twelfth day; a stocking needle loaded with a leaden ball of five and three quarters ounces (Troy), resting with the point upon them, makes no impression, but when held short and thrust in with a slight effort, it easily penetrates them without bending. On the other hand, an excellent hydraulic or water-setting lime, put by the side of the other specimens from the first by way of comparison, now perfectly resists the same trial, the needle bending when pressed against it, instead of piercing it; and yet at the first there seemed to be but little difference between them. Now if a cement four months old, and intended for an hydraulic cement, is still in the state of these chalk-lime specimens, we may be sure that it is of very defective quality, and it would be the height of imprudence to trust to it in works of any kind of importance.

In order to vary my experiments, I took advantage of a circumstance that usually occurs in all the lime-kilns where fresh wood and fuel is employed that draws a long flame. The pillars of the vault that support the limestone are themselves calcined after a time, and converted to lime, but the lower part of them being always covered with the ashes and rubbish, is much less completely burned; so that the same pillar exhibits in its substance every different degree of calcination, in proceeding from the base, which is merely blackened to the upper portion, which is perfect lime.

I happened to find all these progressive states in a large limestone block, which served as the basis of the kiln. In
this

this I made out five distinct degrees of calcination: the first has the deep grey colour, which the first impression of moderate heat makes on every limestone; the second is a clearer grey; the third is a dirty white, with a slightly shining fracture, like gypsum; the fourth a dead white, but its texture compact; and the fifth, or the most highly calcined, has both a dead white hue and a soft chalky texture.

The latter, when slaked in water, heats and falls to pieces rapidly; in the fourth degree, the slaking is slow, but takes place finally after some hours; but on the three first water appears to have no action. In these, the limestone was found still nearly as hard as before exposure to heat (being a hard pure stone fit for building), when reduced to powder in an iron mortar, sifted, and then slaked with water like Paris plaster, they each gave me a cement breaking short in the hand, which was immediately immersed under water. In a month's time the three samples had only acquired a slight tenacity, which could hardly be called *setting*, gave very little resistance to the thrust of a needle, much less than the samples of pure chalk-lime. Three square lumps made from the same samples were exposed to the air; they all hardened by drying just as wetted clay would do, and after a month's exposure, being then dipped into water, the first and second samples fell into small fragments, but the third, which had been more burned than the two first, kept its shape under water, and became covered with a slight crust of carbonate.

These experiments are far from confirming the results announced by M. Minard. I have much difficulty in believing that we shall even obtain, I will not say good, but only tolerable, water cement by a greater or less degree of calcination of the pure calcareous stones. In all probability

probability we must continue to have recourse to the argillaceous limestones, and must direct our attention to classify them according to their relative proportions of clay and lime. We shall perhaps find that none answers so perfectly as the limestone of this species, which, when slaked, encreases in bulk from one to three parts upon ten, and when in the form of a slaked paste, 100 measures will take 160 to 180 measures of sand, thus affording at a moderate cost, a cement equally fitted to resist the changes of the weather, and the still greater trial of constant exposure to running water.

On the Hydroxanthic Acid, with some of its Products and Compounds. By Mr. W. C. ZEISE, Professor of Chemistry at Copenhagen.

Abridged from the *ANNALES DE CHIMIE ET DE PHYSIQUE.*

Concluded from Page 254.

X*ANTHURET* of Copper is thus prepared, using a very weak sulphate or muriate of this metal, and taking care to leave an excess of the metallic salt in solution. The xanthuret separates in flocculi, more or less bulky, according to the strength of the respective solutions. It should be thoroughly washed, and then dried at a gentle heat. Its colour is a fine yellow, with a peculiar smell. Heated with potash it turns black. It is scarcely affected by sulphuric or muriatic acid; but strong nitric acid dissolves it easily, producing a peculiar gas, and a substance like fat in appearance.

When the xanthuret of copper is heated gradually, without addition, in an apparatus which collects all the products, it first gives out oily vapours without changing colour;

colour; when the heat much exceeds that of boiling water, the salt turns of a dark brown, giving out an oil and a gas smelling like onion. The whole ceases at a red heat; and a black residue is left, which a strong heat in the open air reduces to a substance resembling protoxyd of copper.

Xanthuret of lead is prepared like the latter salt, only employing the nitrate of lead instead of the salt of copper. It is white, and separates in flocculi; it dries into singularly light and glittering particles. It has no smell; is insoluble in water, but slightly dissolves in alcohol; by long keeping it turns brown, either dry or in solution. When decomposed by slow distillation, as in the former instance, the appearances are much the same as those of the xanthuret of copper. The oily product resembles the liquid which I have described as *xanthic oil*. The black residue appears by the test of nitric acid to contain both sulphur and charcoal.

Xanthuret of mercury.—This is obtained by pouring hydroxanthate of potash into a solution of cyanuret or deutochloride of mercury (corrosive sublimate). It is without scent or colour, dries into hard grains, which by long keeping turn yellow. Heated by itself, it becomes yellow, melts with a strong effervescence, and passes into black, giving out the same oil and onion-smelling gas. After a time a grey sublimate condenses in the upper part of the retort, which ceases before the heat at the bottom of the retort is urged to redness. A black residue is left, which is very light, and burns in the open air like mere charcoal, and without any smell of sulphur. The sublimate, when reduced to powder, becomes of a more or less intense red, according to the heat at which it was sublimed. It appears to be cinnabar, or at least a substance much resembling it.

Xanthuret of zinc.—I give this term to the precipitate formed by the hydroxanthate of potash and sulphate of zinc, though it probably may be a hydroxanthate of zinc. When fresh it is white, but soon becomes greenish. Its form is that of small crystalline grains, hard and heavy. It dissolves in water and in alcohol; in the former sparingly. Muriatic acid acts upon it strongly, and disengages hydroxanthic acid. When heated in a glass vessel, it fuses with effervescence, and after a time solidifies into a green mass. A stronger heat reduces a portion of the metal, and on continuing it, almost the whole evaporates. The green mass effervesces with muriatic acid, giving out the smell of sulphuretted hydrogen.

Hydroxanthic acid.—The acid which is formed by the action of carburet of sulphur on the solution of potash in alcohol, may exist in an insulated state. This acid is liquid at a common temperature, and much below it, and exactly appears like a transparent colourless oil. Its specific gravity is greater than that of water, with which it does not unite. When exposed to the air, it is soon covered with an opake white crust. If it is much divided by agitation with water, it is soon completely destroyed, the acid being decomposed under the water, with the evolution of bubbles of gas.

Its smell is strong and peculiar. Its taste is at first acid, then strongly astringent and bitter. It strongly reddens litmus.

The hydroxanthic acid is thus prepared: the hydroxanthate of potash is put into a long and narrow glass, sulphuric acid, diluted with four or five volumes of water, is poured on, and the mixture, when slightly shaken, becomes milky: in a few minutes three or four volumes of water are added in such a manner that the new acid may collect in a mass at the bottom of the vessel;
and

and then fifty or sixty more volumes of water are added. The water is then drawn off and new portions added as quickly as possible, and again removed till it ceases to render barytic-water turbid. Muriatic acid will answer as well as sulphuric; but whichever is used, care must be taken that it be neither too concentrated nor too dilute: in the former case the hydroxanthic acid will be more or less altered; and in the second scarcely any acid is procured, probably because the dilution causes it to come in contact with water in so many points that the acid is decomposed before it has time to collect. To obtain the acid as free as possible from water, it should be drained off in a funnel provided with a glass cock.

Hydroxanthic acid easily dissolves in a solution of any of the alkalies, expelling carbonic acid from their carbonates, and producing neutral salts exactly resembling those formed by the union of the alcoholic alkali with carburet of sulphur, as described above. In like manner the oxyds of copper, lead, and mercury, added to this acid under water, give rise to xanthurets exactly similar to those obtained by precipitation.

This acid suddenly takes fire in the air by the contact with a kindled body, giving out a strong odour of sulphureous acid. This acid, when heated by itself, is decomposed at a heat much below that of boiling water: it appears that carburet of sulphur is then formed and an inflammable gas, which however has no smell either of onions or of sulphureous acid.

Some circumstances having led me to suppose that this new acid contained hydrogen, I had recourse to iodine to ascertain the fact.

When iodine is added to newly-prepared hydroxanthic acid under water, an immediate action takes place; the
iodine

iodine is set in motion on the surface of the acid, and dissolves; and the acid becomes opake, yellow, and then brown, and a brown-red oily liquid soon collects at the bottom of the vessel. But in a few minutes, if the iodine has not been added in excess, the colour becomes clearer, and an opake yellow oil is the result. A milky watery fluid, nearly colourless, swims above the oil, which when rendered clear by filtration has the following properties: when mixed with chlorine, or with concentrated nitric acid, it assumes a red colour which an excess of chlorine again destroys; with nitrate of lead it gives a copious bright yellow precipitate; with nitrate of silver it gives an abundant white precipitate, insoluble in ammonia; and with corrosive sublimate, a precipitate which soon becomes an exceedingly beautiful red. It is evident, therefore, that the liquor resulting from the action of iodine on hydroxanthic acid must be considered as a solution of hydriodic acid.

When the iodine has been used in excess, a watery brown liquid is generated, which resembles a solution of ioduretted hydriodic acid in all its habitudes, with the different re-agents.

On the other hand, a mixture of carburetted sulphur, iodine and water, merely assumes a violet colour, owing to the combination of the iodine with the carburet, but not a trace of hydriodic acid can be detected.

In treating a solution of hydroxanthate of potash by iodine, an opake oily liquid is separated from the hydroxanthate. I hope to be able to employ iodine, to determine the proportion of hydrogen in hydroxanthic acid,

List of Patents for Inventions, &c.

(Continued from Page 256.)

ABRAHAM HENRY CHAMBERS, of New Bond-street, Middlesex, Esq ; for improvements in preparing and paving horse and carriage-ways. Dated February 28, 1824.

RICHARD EVANS, of Bread-street, Cheapside, London, Wholesale Coffee Dealer ; for a method or process of roasting or preparing coffee and other vegetable substances, with improvements in the machinery employed, such process and machinery being likewise applicable to the drying, distillation, and decomposition of other mineral, vegetable, and animal substances, together with a method of examining and regulating the process whilst such substances are exposed to the operations before-mentioned. Dated February 28, 1824.

JOHN GUNBY, of New Kent Road, Surrey, Sword and Gun-manufacturer ; for a process by which a certain material is prepared and rendered a suitable substitute for leather. Dated February 28, 1824.

JOHN CHRISTIE, of Mark-lane, London, Merchant, and **THOMAS HARPER**, of Tamworth, Stafford, Merchant, for their improved method of combining and applying certain kinds of fuel. Dated February 28, 1824.

WILLIAM YETTS, of Great Yarmouth, Norfolk, Merchant and Ship-owner ; for certain apparatus to be applied to a windlass. Dated February 28, 1824.

JAMES WRIGHT RICHARDS, of Caroline-street Birmingham, Warwickshire, Metallic Hot-house Maker ; for an improved metallic frame, and lap, applicable to
all

all hot-houses, green-houses, horticultural frames and glasses, sky-lights, and other inclined lights and glasses. Dated February 28, 1824.

WILLIAM GREAVES, of Sheffield, Yorkshire, Merchant; for certain improvements on, or additions to, harness, principally applicable to carriages drawn by one horse. Dated February 28, 1824.

WILLIAM JAMES, of Wesminster, Land Agent and Engineer; for certain improvements in the construction of rail and tram-roads or ways, which rail or tram-ways, or roads are applicable to other useful purposes. Dated February 28, 1824.

MAURICE DE JOUGH, of Warrington, Lancashire, Cotton-spinner; for a mode of constructing and placing a coke-oven under or contiguous to steam or other boilers, so as to make the heat arising from making coke or other intense combustion in the said oven, subservient to the use of the boiler, instead of fuel used in the common way, and to exclude such heat from the boiler, when required, without detriment to the operations of the oven. Dated February 28, 1824.

CHARLES BAGENELL FLEETWOOD, of Parliament-street, Dublin, Ireland, Gentleman; for a liquid and composition for making leather and other articles waterproof. Dated February 28, 1824.

JOEL SPILLER, of Chelsea, Middlesex, Engineer; for an improvement or improvements in the machinery to be employed in the working of Pumps. Dated March 6, 1824.

JOHN HEATHCOAT, of Tiverton, Devonshire, Lace-manufacturer; for a new method of manufacturing certain parts of machines used in the manufacture of lace, commonly called bobbin-net. Dated March 9, 1824.

JOHN

JOHN HEATHCOAT, of Tiverton, Devonshire, Lace-manufacturer; for certain improvements in machines now in use for the manufacture of lace, commonly called bobbin-net, and a new method of manufacturing certain parts of such machines. Dated March 9, 1824.

JOHN HEATHCOAT, of Tiverton, Devonshire, Lace-manufacturer; for an improved economical method of combining machinery used in the manufacture of lace in weaving and in spinning, worked by power. Dated March 9, 1824.

WILLIAM DARKER MOSLEY, of Radford, Nottinghamshire, Lace-manufacturer; for certain improvements in the making and working of machines used in the manufacture of lace, commonly called bobbin-net. Dated March 10, 1824.

WILLIAM MORLEY, of Nottingham, Lace-manufacturer; for various improvements in machines or machinery now in use for the making lace, or net, commonly known by the name of bobbin-net. Dated March 15, 1824.

RUPERT KIRK, of Osborne-street, Whitechapel, Middlesex, Dyer; for a new method of preparing or manufacturing a certain vegetable substance, growing in parts abroad beyond the Seas, and imported to and used in these kingdoms as a dye or red colouring matter for the use of dyers, called safflower (*carthamus*), so as more effectually to preserve its colouring principle from decay or deterioration, in its passage from the places of its growth to England and other parts of Europe. Dated March 20, 1824.

JEAN HENRY PETITPIERRE, of Charlton-street, Somers-town, Middlesex, Engineer; for an engine or machine for making the following articles from one piece of leather,

leather, without any seam or sewing whatever ; that is to say, all kinds of shoes and slippers, gloves, caps, and hats, cartouche-boxes, scabbards, and sheaths for swords, bayonets, and knives. Dated March 20, 1824.

JAMES ROGERS, of Marlborough, Wiltshire, Surveyor ; for an improved method, or an improved instrument or instruments for determining or ascertaining the cubic contents of standing timber. Dated March 20, 1824.

JOHN LINGFORD, of Nottingham, Lace Machine-manufacturer ; for certain improvements upon machines or machinery now in use, for the purpose of making that kind of lace, commonly known or distinguished by the name or names of bobbin-net, or Buckinghamshire lace-net. Dated March 20, 1824.

JOHN HEATHCOAT, of Tiverton, Devonshire, Lace-manufacturer ; for improvements in certain parts of the machinery used in spinning cotton, wool, or silk. Dated March 20, 1824.

HENRY BERRY, of Abchurch-lane, London, Merchant ; for certain improvements on a machine or apparatus for more readily producing light. Dated March 20, 1824.

JEAN JACQUES STAINMARC, of Belmont Distillery, Wandsworth-road, Vauxhall, Surrey, Distiller ; for improvements in the process of, and apparatus for distilling. Communicated to him by certain foreigners residing abroad. Dated March 20, 1824.

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AGRICULTURE.

No. CCLXIV. SECOND SERIES. May 1824.

Specification of the Patent granted to SAMUEL PARKER, the younger, of Argyle-street, in the Parish of St. James, Westminster, and County of Middlesex, Bronzist; for certain Improvements in the Construction of Lamps.

Dated December 10, 1822.

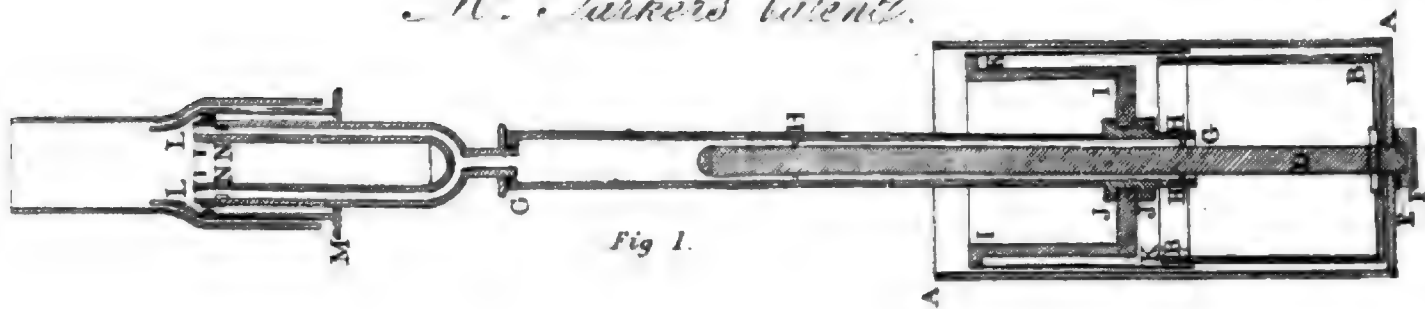
With an Engraving.

TO all to whom these presents shall come, &c.
NOW KNOW YE, that in compliance with the said proviso, I the said Samuel Parker do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawing hereunto annexed, and the following description thereof; that is to say: My improvements are chiefly applicable to that description of lamps termed static lamps, or those lamps in which the oil is raised to the proper burning height from below, by the pressure of the superincumbent parts. In the drawing AA, Fig. 1 (Plate XIV.) is a cylindrical vessel (shewn in section) open at top and closed at bottom; BB is another cylindrical vessel of the same description, but shorter than the other, and of a diameter somewhat less;

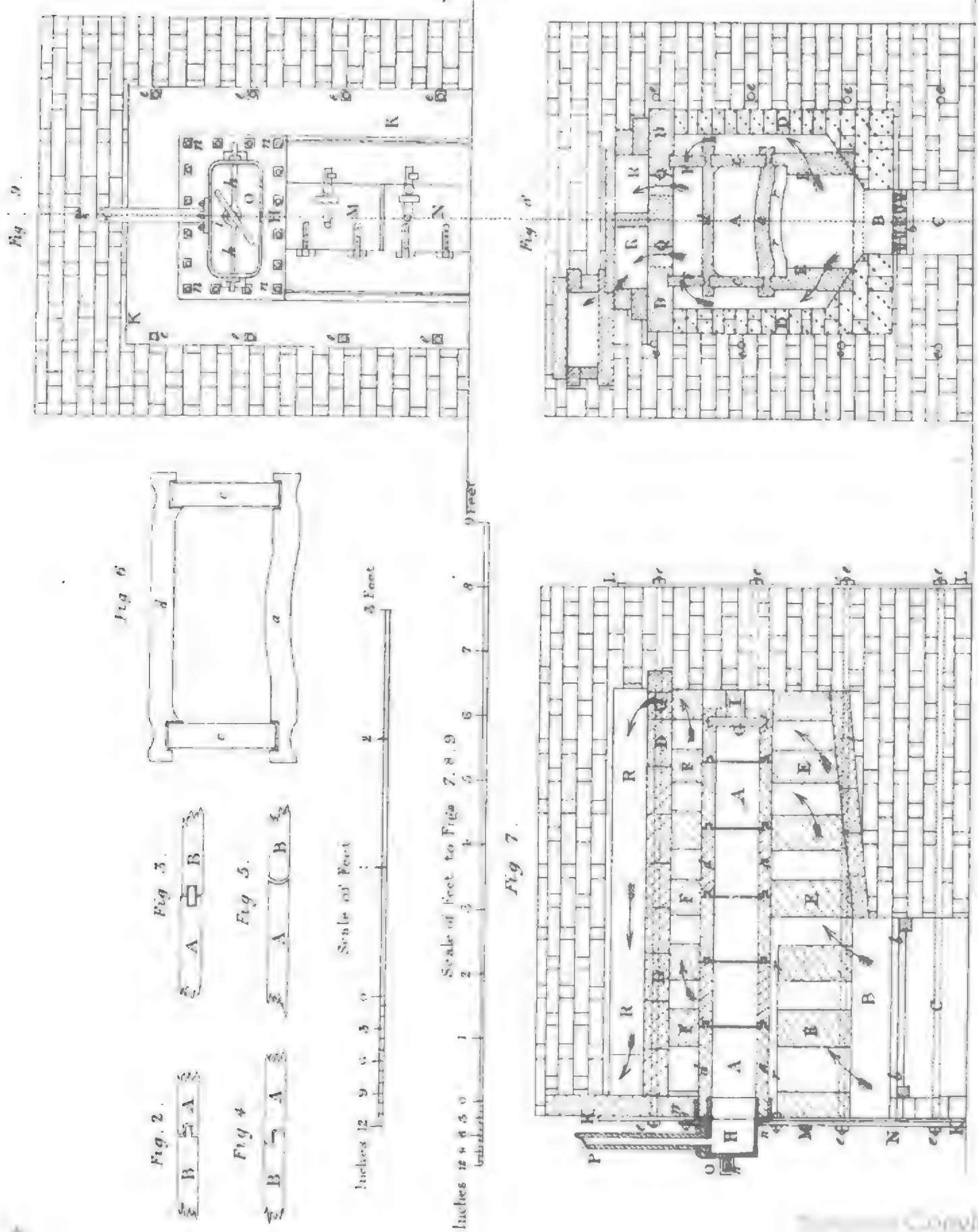
VOL. XLIV.—SECOND SERIES. T t less;

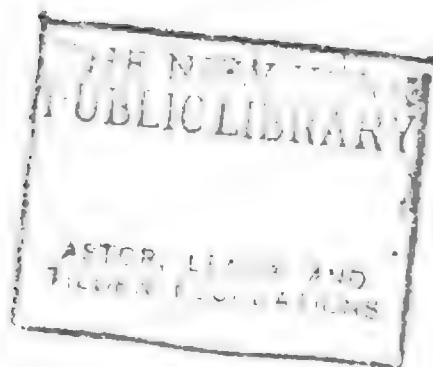
less; the bottoms of both these vessels are united by means of the screw C, and the shoulder of the cylindrical stem D shewn entire, having a collar of leather E and a screwed nut F upon it (shewn in section); and by means of which the closure is firmly and securely made, the cylindrical vessels kept concentric with each other, and the stem D in its proper situation. The tube G G moves up and down this stem, being guided by means of the steady pins or screws H H, &c. acting upon it, and which pins are screwed into the tube G G. To the tube G G, the heavy cylindrical vessel I I is firmly fixed between the shoulders at J J, and made air-tight at the juncture. Upon the outer rim or border of this vessel I I, a thin cylindrical ring K K is securely affixed and made air-tight, also a certain quantity of mercury or quicksilver is then poured into the space between the rims of the vessels A A and B B, into which the lower border of the ring K K is plunged, and thus effectually prevents the escape of the air which is inclosed between the vessels K K and B B. If now oil be poured into the upper part of the tube G G, it will occupy the lower part of the vessel B B, and rise in the tube, also being pressed up by the properly adjusted weight of the parts resting upon it to the burning height. Between the oil, however, and the outside of the vessel I I, a quantity of air is as before said interposed, which will act by its elasticity in such a manner as to permit of the lamp being carried about when necessary, without the previous removal of the greater part of the superincumbent weight, which in my improvement is rendered totally unnecessary. I also obtain another very considerable advantage from the introduction of the air into the interior of the reservoir of the lamp, which is, that the oil and mercury never come into contact with each other, as was the case in other static lamps,

W. Parker's Patent.



W. Grafton's Patent.





lamps, and which rendered it necessary frequently to remove the mercury, in order to separate the oil which was mixed with it. I have also made an improvement in the manner of fixing the French glass chimnies upon the burners of lamps, which consists in supporting its chimney by its shoulder internally resting upon three or more metal supports, two of which are shewn at L L, and which are affixed to the turning adjuster M of the lamp-wick, instead of its bottom resting upon the said adjuster. In this manner I can always adjust the shoulder of the chimney in the best position for causing the air to act upon the flame of the lamp, but which can hardly be done when it rests upon its bottom, on account of the great irregularity in the lengths of the chimnies as usually made. I have also made several notches or gaps N N in the inner tube of the burner, to allow any oil which might overflow to fall into the vessel I, instead of drowning the flame. The materials of which the various parts inclosing the mercury are made, must of course be such as are not liable to be acted upon by that metal; I prefer cast and wrought iron for this purpose. The other parts of this lamp, being common to Argand or other lamps, need not be described here; but it is evident that my invention is equally applicable to all those lamps which are supported upon pillars or pedestals, as well as those which are suspended, be the number or form of their burners whatever they may; and also that the exterior of the lamps may be decorated in any required manner. My improvements therefore consist in retaining the oil in a separate and distinct vessel from the mercury, and thereby preventing them from mixing together, and thus avoiding the tedious process of separating them from time to time; also in the introduction of air as an elastic medium between the oil and the mercury, and thereby rendering my

my lamp moveable without affecting the flame; likewise in providing an escape for the overflow of the oil above; and, lastly, in supporting the French chimnies of all Argand lamps upon their shoulders instead of their bottoms resting upon the glass holders as usual.

In witness whereof, &c.

Specification of the Patent granted to JOHN GRAFTON, of Edinburgh, Civil Engineer; for a new and improved Method or Methods of Distilling off the Products of Coal, and carbonizing Coal in the Process of making Gas used for the Purposes of Illumination.

Dated July 11, 1820.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Grafton have executed this instrument, by which I do declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in manner following; that is to say: My invention of a new and improved method or methods of distilling off the products of coal, and carbonizing coal in the process of making gas used for the purposes of illumination, consists in a new and improved manner of constructing the vessels or retorts used for carbonizing coal, to produce gas for the purposes of illumination. I construct the vessel or retort of a material known by the name of Stourbridge fire-brick clay, or any other good description of fire clay, which may be found to resist the action of the fire sufficiently without vitrifying or cracking, which material has been heretofore tried for retorts but totally failed,

failed, in consequence of those retorts having been made in one entire piece, which caused them to break in pieces very shortly after the fire was applied.

The substance usually employed for making retorts to carbonize pit-coal is cast-iron, which substance is quickly destroyed by the combined action of the external fire in the furnace and the heated coke contained within the retort; this induced me to try other substances capable of resisting the action of the fire more completely, and at the same time to construct them in such manner as not to be easily cracked or broken by the operation of the fire.

I cause the retort to be made of fire-clay, and composed of several pieces, which may be put together by any proper cementing substance or mortar, such as the fire-clay made wet, or other material which will not drop out or be destroyed when exposed to the heat. The means I adopt of forming the joinings where the pieces connect are various, but some of those which I have found to answer the intended purpose very well, are represented by figures contained in the annexed drawings or plans. Fig. 2 (Plate XIV.) shews two of the portions of a retort as they would appear in the direction of the length of the retort joined together, by forming a small square groove or channel round the end of one piece A, and a corresponding projecting rib round the end of the contiguous piece B, which rib is to be inserted into the channel, and rendered air-tight, or nearly so, by any soft cement or mortar introduced at the time that the two pieces are put together.

Another form of joining is represented by Fig. 3, where the ends of both portions A and B have a channel formed round them (similar to A, Fig. 2), and a hoop or ring of metal introduced, so as to enter one half of its width into each channel, and rendered air-tight by cement in the manner above mentioned.

Fig.

Fig. 4 shews a form of joint which is similar to the fitting of a turned box lid, where the internal part of the piece A is enlarged for a short distance, and the external part of B diminished in size, so as to be capable of being inserted into A, as shewn by the figure, and rendered tight by cement.

The joining represented by Fig. 5 is very simple, and found to be sufficiently secure; the end of the piece A is formed somewhat concave or hollow round its edge, whilst the edge of the piece B is rounded or convex, so as to fit the concave part, and may be pressed together with cement between the joint, and prevented from separating when fixed by the peculiar arrangement of the parts of the furnace in which the retort is intended to be placed, and which will be hereafter explained, although I make no claim to the construction of the furnace, but confine myself solely to the construction of retorts for gas-light apparatus, made in detached or separate portions of fire-clay, which are baked or burned previous to their being joined together for use, since by such method I can render them very durable in fire-clay, which could not be effected by any manner of constructing them in one entire piece as heretofore attempted.

Fig. 6 on the drawing shews a cross section of the retort on a large scale, to explain how the joinings are made in the direction across its length; it is composed of two side pieces *c c*, and a top and bottom piece as shewn by the Figure 6, or according to either of the methods described in Fig. 2, 3, 4, or 5; or in any other manner which may be found convenient and secure.

The various portions which compose my improved retort are to be formed in moulds, or otherwise well shaped, so that the parts where the joinings occur may fit properly together, after which they are to be baked or burnt
in

in the manner of bricks or pottery, before they are put together in the furnace for use.

Fig. 7 on the sheet of drawings represents a longitudinal section of a furnace, to explain how my new retorts are placed and secured, in order to prevent the detached portions from separating and allowing the gas to escape during the operation of carbonizing.

Fig. 8 represents a transverse section taken through the retort and furnace; and Fig. 9 a front view of the external part of the furnace, to shew the iron mouth-piece of the retort, fire-door, ash-pit, &c.

The same characters or letters of reference denote the same parts on the Figs. 7, 8, and 9. A, the retort, which is composed of fire-clay as above described, and inclosed in an oven or chamber formed by the walls D, D, D, which are made with fire-bricks or baked clay, similar to the retort.

The walls D, D, D, are surrounded by a considerable thickness of common brick-work, to form the exterior of the furnace, which is coloured red in the drawing (drawn to represent brick-work in the plate), whilst the fire-bricks or clay is coloured yellow (distinguished by dotted crossing in the plate). B, the body of the furnace where the fire is made; it is supplied with air from the ash-pit C, through the grating bars *b*, Figs. 7 and 8.

The bottom *a* of the retort is supported upon piers of fire-clay or brick E, E, E, which are situated in a row on each side, extending the whole length of the retort, as shewn by Fig. 7, having spaces left between them for the flame and smoke to pass through from the furnace B; the piers E, E, E, are placed immediately under the joining in the retort, which renders the joinings very secure from injury; the upright sides of the retort *cc* are inserted a short distance into channels formed in the bottom *a*, and the uppermost edges of the sides are also inserted

inserted into channels in the top piece *d*, which prevent the sides from going asunder; the top piece *d* is kept down, and rendered firm by the insertion of small piers of fire-clay *F, F, F*, placed upright between the top piece *d* of the retort and the roof of the chamber *D*; these piers have spaces left between them for the flame to pass through, similar to those under the bottom of the retort, and the piers are situated immediately over the joinings in the same. One end of the retort at *G* is closed by fire-clay, of the same description as the sides and bottom, and secured by a pier of the same material extending to the back wall at *I*, Fig. 7; the mouth-piece *H* of the retort is of cast-iron or other fit metal, formed like a square frame, of such dimensions as to embrace the end of the clay retort, and also enter into it for a short distance, as seen by the longitudinal section at *H*; it has a projecting flanch, through which screw bolts *n n* are passed to unite it firmly with the front plate *K* of the furnace, which is also of cast-iron, and of the form seen at *K K* in Fig. 9. A similar plate to *K K*, or otherwise bars of metal, are placed at the back of the furnace wall, as shews at *L L*, Fig. 7; these two plates are united by long wrought-iron bolts passing entirely through the brick-work of the furnace, at such distance from the inside as not to be materially injured by the action of the fire, and secured by nuts screwed on their ends or otherwise, as seen at *e, e, e, e*, Fig. 7, 8, and 9; by this arrangement the whole of the furnace is firmly bound together, so as to avoid the danger of breaking the joinings in the retort, by the expansion or contraction of the brick-work composing the furnace. The front plate *K* has the fire-door *M*, Fig. 9, attached to it, as also the ash-pit door *N*, which serves to regulate the draught of air through the furnace, or to damp the fire when the operation of carbonizing is completed.

pleted. The coal or other substance from which gas is to be produced, or introduced through the mouth-piece H, which has an iron door or cover O fitted to it, and secured by a cross bar *h h*, which bar may be removed when the coal is introduced or the coke withdrawn from the retort; the cover O is pressed close up to the mouth-piece by means of a screw *i*, having a cross handle to turn it by; P, the pipe which conveys the gas off from the retort as fast as it is generated. The fire is made in the body of the furnace at B, and the flame ascends against the bottom of the retort, which is guarded immediately over the fire by a piece of burnt fire-clay or other fit material, shewn at *rr*, to prevent an excess of heat at that part so as to injure the retort; the flame passes through the openings between the piers E E, rises up on each side of the retort, then through the spaces between the piers F F over the retort, and escapes through an opening or openings at the back of the furnace, as seen at Q Q, Figs. 7 and 8, into a flue R formed above the roof of the chamber D, along which it passes in its way to the chimney or vent, as shewn by the direction of the small darts or arrows in the figures.

The common brick-work is continued some height above the flue R, to keep the top of the chamber D and retort firm by its incumbent weight. I have described a furnace containing only one retort, but two or more may be placed in the same furnace, provided that the piers of fire-clay before described are introduced between them so as to support and keep the portions of the retort together.

The dimensions and proportions of the parts may be varied according to the discretion of the workmen.

In witness whereof, &c.

Specification of the Patent granted to JONATHAN BROWN-ILL, of Sheffield, in the County of York, Table-knife Cutler; for a Method for better securing the Blades of Table-knives and Forks in the Handles, by Means of Caps being soldered upon the Tangs, whether of Iron, Steel, or other Material, after the Handles are upon them. Dated June 8, 1820.

With an Engraving.

TO all to whom these presents shall come, &c. Now KNOW YE, that in compliance with the said proviso, I the said Jonathan Brownill do hereby describe and ascertain the nature of my said invention, by the following description thereof; that is to say: That part of the knife or fork called the tang, whether a scale tang or round tang, I make of sufficient length to go through the handle, and project as much through it as is requisite for the soldering and fastening of the cap upon it. I tin the end of the tang in the manner in which iron or other metal is generally tinned, that is, by dipping it, when cleaned, into water wherein sal ammoniac has been dissolved, or otherwise, and by then putting it into hot tin, and unless the handle will bear the heat requisite in the process of such tinning, I tin the tang before it is put into the handle. And, as a further security for the keeping on of the cap, I spread or beat out the end of the tang, if a round tang, or make what is called a gainshire, or drill a hole through the tang, whether a scale tang or round tang, in that part which projects through the handle, so that the metal or solder may take hold of, or otherwise pass through, either kind of tang (see Fig. 1, Plate XVI), But if such tang be of a sufficient length and strength, and well tinned, the other process, namely, that of spreading or beating out the tang, making the gainshire, or drilling

drilling the hole, is not very essential, and is only used by me in cases when much strength is required. And in some cases I put a small piece of wire through the hole above described (see Fig. 2); or when there is a fear of the solder not taking sufficient hold of the tang, I make that part of the tang, if round, which projects, square, and put up it, in the first instance, a strong tinned inner cap, by making a square hole in the centre of the cap, so as to fit tight upon the tang, and then cutting off the tang so as to leave sufficient to make what is called a good rivet, by hammering it upon the end. This inner cap being thus firmly secured, when I unite the other or outer cap I put in as much solder as will fill the vacuum between the two caps, the end of the tang, where is the rivet, being first made clean and tinned, as before specified. The tang being thus prepared, or the inner cap being fixed as above mentioned, I prepare the outer cap, of whatever material it is made, being always hollow or dished, in manner following: I tin it, when made of iron, in the inside, by the process before mentioned. If made of silver, copper, brass, or any similar metal, it is only needful to make the inside of the cap clean, and to put a little resin with the solder, and when of sufficient heat it will cause the solder to unite firmly with the cap. When the cap is sufficiently filled with the solder, and also sufficiently heated, the tang of the blade must be put into it whilst thus hot; and when I am satisfied the cap is pressed close to the handle, and in the situation in which I wish it to be, I raise up, and put it into cold water, so that the handle may not be damaged by the heat of the metal or solder. The solder I use in the above processes is made of tin and lead, being of the same kind as is generally used by plumbers and others.

In witness whereof, &c.

On

*On Fluid Chlorine. By M. FARADAY, Chemical Assistant
in the Royal Institution.*

From the PHILOSOPHICAL TRANSACTIONS of the
ROYAL SOCIETY of LONDON.

IT is well known that before the year 1810 the solid substance obtained by exposing chlorine, as usually procured, to a low temperature, was considered as the gas itself reduced into that form; and that Sir Humphrey Davy first showed it to be a hydrate, the pure dry gas not being condensible even at a temperature of 40° F.

I took advantage of the late cold weather to procure crystals of this substance for the purpose of analysis. The results are contained in a short paper in the Quarterly Journal of Science, vol. XV. Its composition is very nearly 27.7 chlorine, 72.3 water, or one proportional of chlorine, and ten of water.

The President of the Royal Society having honoured me by looking at these conclusions, suggested, that an exposure of the substance to heat under pressure, would probably lead to interesting results, the following experiments were commenced at his request. Some hydrate of chlorine was prepared, and being dried as well as could be by pressure in bibulous paper, was introduced into a sealed glass tube, the upper-end of which was then hermetically closed. Being placed in water at 60°, it underwent no change; but when put into water at 100°, the substance fused, the tube became filled with a bright yellow atmosphere, and, on examination, was found to contain two fluid substances; the one, about three-fourths of the whole, was of a faint yellow colour, having very much the appearance of water; the remaining fourth was
a heavy

a heavy bright yellow fluid, lying at the bottom of the former, without any apparent tendency to mix with it. As the tube cooled, the yellow atmosphere condensed into more of the yellow fluid, which floated in a film on the pale fluid, looking very like chloride of nitrogen; and at 70° the pale portion congealed, although even at 32° the yellow portion did not solidify. Heated up to 100° the yellow fluid appeared to boil, and again produced the bright coloured atmosphere.

By putting the hydrate into a bent tube, afterwards hermetically sealed, I found it easy, after decomposing it by a heat of 100° , to distil the yellow fluid to one end of the tube, and so separate it from the remaining portion. In this way a more complete decomposition of the hydrate was effected, and, when the whole was allowed to cool, neither of the fluids solidified at temperatures above 34° , and the yellow portion not even at 0° . When the two were mixed together, they gradually combined at temperatures below 60° , and formed the same solid substances as that first introduced. If, when the fluids were separated, the tube was cut in the middle, the parts flew asunder as if with an explosion, the whole of the yellow portion disappeared, and there was a powerful atmosphere of chlorine produced; the pale portion on the contrary remained, and when examined, proved to be a weak solution of chlorine in water, with a little muriatic acid, probably from the impurity of the hydrate used. When that end of the tube in which the yellow fluid lay was broken under a jar of water, there was an immediate production of chlorine gas.

I at first thought that muriatic acid and euchlorine had been formed; then, that two new hydrates of chlorine had been produced; but at last I suspected that the
chlorine

chlorine had been entirely separated from the water by the heat, and condensed into a dry fluid by the mere pressure of its own abundant vapour. If that were true, it followed, that chlorine gas, when compressed, should be condensed into the same fluid, and, as the atmosphere in the tube in which the fluid lay was not very yellow at 50° or 60° , it seemed probable that the pressure required was not beyond what could readily be obtained by a condensing syringe. A long tube was therefore furnished, with a cap and stop-cock, then exhausted of air and filled with chlorine, and being held vertically with the syringe upwards, air was forced in, which thrust the chlorine to the bottom of the tube, and gave a pressure of about four atmospheres. Being now cooled, there was an immediate deposit in films, which appeared to be hydrate, formed by water contained in the gas and vessels, but some of the yellow fluid was also produced. As this, however, might also contain a portion of the water present, a perfectly dry tube and apparatus were taken, and the chlorine left for some time over a bath of sulphuric acid before it was introduced. Upon throwing in air and giving pressure, there was now no solid film formed, but the clear yellow fluid was deposited, and more abundantly still upon cooling. After remaining some time it disappeared, having gradually mixed with the atmosphere above it, but every repetition of the experiment produced the same results.

Presuming that I had now a right to consider the yellow fluid as pure chlorine in the liquid state, I proceeded to examine its properties, as well as I could, when obtained by heat from the hydrate. However obtained, it always appears very limpid and fluid, and excessively volatile at common pressure. A portion was cooled in
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its tube to 0° : it remained fluid. The tube was then opened, when a part immediately flew off, leaving the rest so cooled by the evaporation as to remain a fluid under the atmospheric pressure. The temperature could not have been higher than -40° in this case; as Sir Humphrey Davy has shown that dry chlorine does not condense at that temperature under common pressure. Another tube was opened at a temperature of 50° ; a part of the chlorine volatilised, and cooled the tube so much as to condense the atmospheric vapour on it as ice.

A tube, having the water at one end, and the chlorine at the other, was weighed, and then cut in two; the chlorine immediately flew off, and the loss being ascertained was found to be 1.6 grains; the water left was examined and found to contain some chlorine; its weight was ascertained to be 5.4 grains. These proportions, however, must not be considered as indicative of the true composition of hydrate of chlorine; for, from the mildness of the weather during the time when these experiments were made, it was impossible to collect the crystals of hydrate, press and transfer them, without losing much chlorine; and it is also impossible to separate the chlorine and water in the tube perfectly, or keep them separate, as the atmosphere within will combine with the water, and gradually reform the hydrate.

Before cutting the tube, another tube has been prepared exactly like it in form and size, and a portion of water introduced into it, as near as the eye could judge, of the same bulk as the fluid chlorine: this water was found to weigh 1.2 grains; a result, which, if it may be trusted, would give the specific gravity of fluid chlorine as 1.33; and from its appearance in and on water, this cannot be far wrong.

Note

Note on the Condensation of Muriatic Acid Gas into the Liquid Form. By Sir H. DAVY, Bart. Pres. R. S.

In desiring Mr. Faraday to expose the hydrate of chlorine to heat in a closed glass tube, it occurred to me that one of three things would happen; that it would become fluid as a hydrate, or that a decomposition of water would occur, and euchlorine and muriatic acid be formed, or that the chlorine would separate in a condensed state. This last result having been obtained, it evidently led to other researches of the same kind. I shall hope, on a future occasion, to detail some general views on the subject of those researches. I shall now merely mention, that by sealing muriate of ammonia and sulphuric acid in a strong glass tube, and causing them to act upon each other, I have procured liquid muriatic acid; and by substituting carbonate for muriate of ammonia, I have no doubt that carbonic acid may be obtained, though in the only trial I have made the tube burst. I have requested Mr. Faraday to pursue these experiments, and to extend them to all the gases which are of considerable density, or to any extent soluble in water; and I hope soon to be able to lay an account of his results, with some applications of them that I propose to make, before the Society.

I cannot conclude this note without observing, that the generation of elastic substances in close vessels, either with or without heat, offers much more powerful means of approximating their molecules than those dependant upon the application of cold, whether natural or artificial; for, as gases diminish only about $\frac{1}{480}$ in volume for every — degree of Fahrenheit's scale, beginning at ordinary temperatures, a very slight condensation only can be produced by the most powerful freezing mixtures, not half

as

as much as would result from the application of a strong flame to one part of a glass tube, the other part being of ordinary temperature: and when attempts are made to condense gases into fluids by sudden mechanical compression, the heat, instantly generated, presents a formidable obstacle to the success of the experiment; whereas, in the compression resulting from their slow generation in close vessels, if the process be conducted with common precautions there is no source of difficulty or danger; and it may be easily assisted by artificial cold in cases when gases approach near to that point of compression and temperature, at which they become vapours.

On an early Variety of Horse Bean.

By W. PYLE TAUNTON, Esq. of Cheam.

FROM THE TRANSACTIONS OF THE SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, AND COMMERCE.

(Concluded from Page 291.)

THE beans which grew in the turnip-loam soil, called Peach's Close, grew on land dug by the spade, under the following circumstances: Peach's Close is my experiment-ground, in which I have under cultivation between two and three hundred different species of plants, with a view to the improvement of agriculture; and many of them, particularly the gramina, are disposed in square beds of a rod each, with an alley of the width of three feet in every direction between bed and bed, which serves as a path. The whole of the ground on which these beds are situate, in the autumn of 1819, was sown part with winter peas, part with Canada tares, succeeded by stubble-turnips, which were poor; after which crops, in the autumn of 1820, I ploughed the land deeply and re-

peatedly, say three or four times, dunged it well, and laid it out in beds; and in September, 1820, sowed it with sundry grasses. Not to waste the space of the alleys, in the first year, while the grasses in the intermediate beds were in their infancy, I sowed some part of the alleys, in autumn 1820, with various annuals, and among others with winter beans. In autumn 1821, I sowed nearly the whole of the same alleys, and also some of the square rod-beds, where the grasses had failed, with winter beans, and these were the beans which I harvested there in 1822, as mentioned in my memorial; upon which I have to observe, that I perceived, in many instances, that dropped beans from the preceding harvest fell upon path-ways and corners, and on beds which had never been dug at all in that year, and came up, and grew quite as well, and bore as well, as the crop on the ground which had been prepared by digging: part of the beans in the alleys and beds I hoed in March, part was neglected, and never hoed at all, and they had to contend with a numerous and luxuriant host of annual weeds. The beans in Peach's Close were the best I had in that year, as I have before observed. My digging in that field was done at the rate of 3*d.* for some, and 4*d.* for others, *per* square rod, varying according to the degree of drought and hardness of the ground; and the beans were dibbled in by a boy, who fed my pigs at his vacant hours; his day-work cost me 6*s.* *per* week, and I suppose he wasted three or four days in dibbling these beans, which might have been done in one. The alleys between the beds being more trodden and hard, I paid in some weather three farthings, and in other 1*d.* *per* rod, run, for digging them, or 4*d.* and 5½*d.* respectively *per* rod square, which was rather too much; but the finishing the work so as not to entrench on the boundary of the

the

the bed on both sides, required more time and care than straight-forward digging does.

In the present year I observe that the scattered beans dropped in the last harvest, on the surface, are come up, and look as hardy, healthy, and forward, as they need to do; whence, as well as from the other premises, I draw the conclusion, that these, like other hardy small horse-beans, require not an expensive tillage; that one ploughing, and two or three turns or tines of the harrow to cover them, would be quite sufficient to ensure a crop. And I would make the following estimate of their culture, according to the practice I should pursue, looking to the bean-crop only, and not looking to the future melioration of the soil, for the purpose of bearing grass or wheat.

	£.	s.	d.
In stiff clay land, one ploughing, <i>per</i> acre	0	17	0
Drilling beans <i>per</i> acre, with Smyth's drill, four horses, drill-man, and driver, at 4s. <i>per</i> acre	0	4	0
Three turns of the drag or harrows, at 8d.	0	2	0
Water-furrowing, say, <i>per</i> acre	0	1	0
Bird-scaring three weeks, say, <i>per</i> acre	0	0	9
Two hoeings in spring, <i>i. e.</i> end of March and end of May, the two, <i>per</i> acre	0	8	0
	£.1	12	9

On my lighter land the ploughing would cost me 5s. *per* acre less, one tine of harrowing less, and no water-furrowing; thus reducing the cost of culture from 1l. 12s. 9d. to 1l. 6s. 1d. *per* acre.

If I were to make either a complete summer fallow, or a partial summer fallow, previous to my sowing the beans, I should be induced to debit in my ledger the succeeding crop with a part of the expense of such fallow,

low, which the row-culture of the beans would enable me to keep clean during the succeeding summer, so as to leave the ground in a very good state of preparation for wheat, or other autumn-sown crops.

If the Committee should not think that my division of the expenses between this crop and the succeeding crops is to be adopted, I must then submit to them the actual cost of the tillage on which they were sown, which I conceive stands as follows :

	s.	d.
In Peach's Close, digging <i>per rod</i>	0	4
Dibbling <i>per rod</i> (through the boy's idleness)	0	2
Hoeing <i>per rod</i> (where performed).....	0	1
	0	7

The amount of spade-culture, at this rate, would be, *per acre* 4*l.* 14*s.* 8*d.* This small parcel was not watched, to preserve them from the birds, therefore no cost thereof is charged here.

	£.	s.	d.
For that which I sowed in the fields : Ruffett,			
three ploughings, one at 17 <i>s.</i> two at 13 <i>s.</i>	2	3	0
Five draggings and harrowings, at 8 <i>d.</i>	0	3	4
Water-furrowing	0	1	0
(Bird-scaring was omitted, this piece being small)			
Drilling beans, <i>per acre</i>	0	4	0
Harrowing in the same, two turns only, <i>per acre</i>	0	1	4
Rolling three times, with heavy stone roller (this operation was performed purely for the sake of the grass), at 9 <i>d.</i> <i>per acre</i>	0	2	3
Hand-weeding in spring, <i>per acre</i>	0	2	0
	£.2	16	11

For

	£.	s.	d.
For the beans in Clay-pond field, must be added hereto, upon all the field, the further cost of bird-searing.....	0	0	9
To which add the preceding charge.....	2	16	11
	£.2	17	8
And on one half of the field, one more plough- ing	0	13	0
Total.....	£.3	10	8

And in East London-lane field the charge differs from the estimate in Ruffett field in this respect, viz.

	£.	s.	d.
Charge on Ruffett field	2	16	11
Deduct two rollings, this having been rolled only once, at 9d. per acre.....	0	1	6
Total cost, per acre....	£.2	15	5

But I beg leave to report, that I should have incurred, and did incur, the whole of these expenses at the same seasons, for the sole purpose of sowing my meadow-grasses, even if I had sown no beans, the combination of which was an after-thought, and, for me, not a very happy one; for in two instances out of the three, namely, in Clay-pond field and West London-lane field, where their growth was most exuberant, they injured the grass; in Ruffett field, where the land was less full of manure, grass succeeded most perfectly under these beans; and as the autumnal sowing of grass is certainly the most advisable, I think I may venture to say, that with due precaution, not to sow the beans too early, or too thick, they may form a useful means of lessening the expense
of

of laying down perennial pastures or meadows in the best manner.

I have to regret, that I was not aware that the Society wished for an estimate of the expense, or I would sooner have submitted it to them, and I hope the above statement will be found satisfactory.

In the pursuit of agricultural improvement, my researches have made me acquainted with several plants, which I cannot but esteem to be valuable acquisitions to our national stores. Among the cerealia, the winter pea, St. John's rye, Spring rye, and Georgian oat, above all the others; among the diadelphous plants, the *hedysarum onobrychis biferum*, or double crop sainfoin; the *trifolium incarnatum*; the bullock clover; *trifolium macrorhizum*; *medicago maculata*; and several others which promise valuable results, the qualities of which I have no time now to enlarge on: nor do I perceive any premiums held out by your Society which particularly call for the exhibition of them; but all of which, as well as the collection of about 200 various species of grass, I shall be happy to render subservient to the good of the community in any way I can most effectually do it.

CERTIFICATES.

I, George Heffer, bailiff to William Pyle Taunton, Esq. hereby certify, that the winter beans which grew in a certain close of rich light loamy sand, called Peach's Close, at Cheam, in the County of Surrey, being 31 square rods, were pulled by James Raissin and Walter Grig, on Wednesday the 10th, Thursday the 11th, and Friday the 12th days of July, 1822; that the winter beans in Claypond field, ten acres, were cut by Thomas Harris, Isaac Purkiss, and William Edington, on Tuesday the 9th, Thursday

Thursday the 11th, Friday the 12th, Saturday the 13th, and Tuesday the 16th of the same month of July; that the winter beans which grew in the West London-lane field, being one acre and sixty-six rods, were cut on Saturday the 13th of the same month, by Thomas Harris and Isaac Purkiss; and that the winter beans which grew in Ruffett field, being one acre and one rood, were cut on Wednesday the 17th, and Thursday the 18th of the same month, by Thomas Harris and William Edington, the said three last-mentioned fields being in the parish of Cuddington, in the said county of Surrey, and all the said fields being in the occupation of the said William Pyle Taunton, and that the whole of the said beans were perfectly ripe, hard, and dry, at the time of harvesting the same; and that the beans sowed at the interval of eighteen inches, in Ruffett field and West London-lane field, were sown too close together, and that the crop would have been better if they had stood at wider distances, because they tillered out so much.

GEORGE HEFFER.

Cheam, Dec. 2, 1822.

I, William Neale, of Cheam, in the county of Surrey, farmer and land-surveyor, hereby certify, that on Monday, July 15, 1822, I inspected the crops of winter beans grown in the three several closes called Clay-pond field, West London-lane field, and Ruffett field, in the parish of Cuddington, in the county of Surrey, in the occupation of W. P. Taunton, Esq. and that the beans in the two first-mentioned fields were then ripe, and already cut and lying on the ground; and that the said beans in Ruffett field then appeared ripe and ready to be cut.

WM. NEALE.

Cheam,

Cheam, Surrey, Dec. 2, 1822.

I, John Andrew, ploughman to Wm. Pyle Taunton, Esq. hereby certify, that in the year 1821, on Wednesday the 12th, and Thursday the 13th days of September, I drilled winter beans over the whole of a close, called Clay-pond field, containing ten acres, two roods, and twenty perches (except the North and South headlands, which are about a quarter of an acre) in single drills, at twelve feet distance between the drills; that on Tuesday September 18, in the same year, I drilled winter beans at the distance of a foot and a half between the drills, over a part of a close called Ruffett field, of the extent of one acre and one rood; and that on Friday the 12th of October, in the same year, I drilled winter beans at the same distance of a foot and a half between the drills, over one acre, one rood, and twenty-six perches, situate at the West side of a field called West London-lane field, all which fields above-mentioned are situate in the parish of Cuddington, in the county of Surrey, and then were and still are in the occupation of William Pyle Taunton, Esq. and the soil thereof is of a stiff, wet, intractable clay.

The mark of JOHN ANDREWS +.

I have the honour to inform you that I have this day, according to your request, weighed with accuracy a bushel of the winter beans, and that the weight of them is 63½ lbs. avoirdupois. I ought to add, that these are some of the beans which were last threshed, and which grew on the acre in Ruffett field, a crop which was less blighted than those I had the honour to send to the Committee

mittee, the latter having been taken from those I first thrashed, and which grew in Clay-pond field and West London-lane field. I suspect that the sample I exhibited to the Society would not weigh quite so much.

With respect to the produce *per acre*, it has, in this last year, in consequence of the blight, been very unequal, and less satisfactory than in any former year. As I did not keep the produce of the several fields distinct, I cannot take upon myself to speak to the produce *per acre* with perfect accuracy; but, to the best of my judgment, the one acre and a quarter in Ruffett field (which was sown the latest) produced to me 21 or 22 bushels; the few rods in Peach's Close, on a drier soil, produced to me after the rate of about thirty bushels an acre. The produce of West London-lane field and Clay-pond field suffered so much by the blight as to be very inferior, and did not, I think, much exceed a sack to an acre.

I have the satisfaction of stating, that after the last winter (which, as the thermometer was several times many degrees below zero, must be thought a strong test for growing beans), I see the bean plants now about three or four inches high, bearing no other mark of the severity of the winter, than their having a brown and scorched edge round some of their lowermost leaves; and some which had lain in the ground during the winter, being sown in the middle of November, are, since the frost, come up perfectly healthy and vigorous.

Description of a Kite for effecting a Communication between a stranded Ship and the Shore.

By Capt. DANSEY, of the Royal Artillery.

With a Plate.

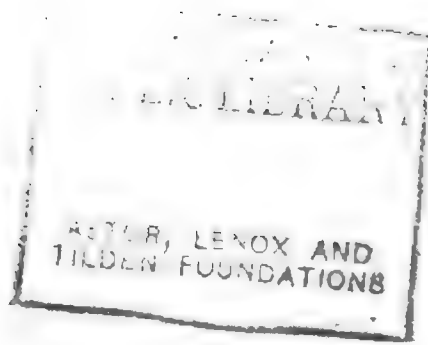
From the TRANSACTIONS of the SOCIETY for the ENCOURAGEMENT of ARTS, MANUFACTURES, and COMMERCE.

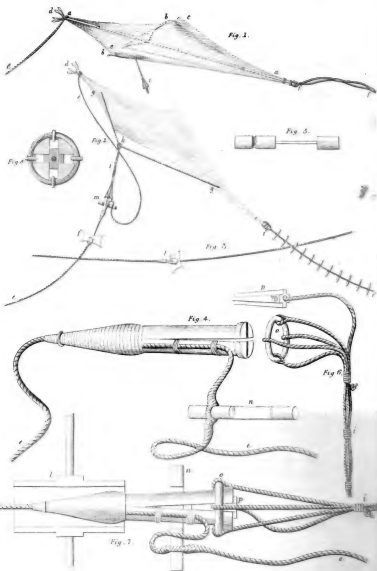
The Gold Vulcan Medal was presented to Capt. DANSEY, for this Communication.

I BEG to submit to the Society for the Encouragement of Arts, &c. the outline of an expedient for facilitating communication with vessels stranded on a lee-shore, or under other circumstances where badness of weather renders the ordinary means impracticable.

A sail of light canvas or Holland (being cut to the shape, and adapted for the application of the principles of the flying kite), is launched from the vessel or other point to windward of the space over which a communication is required, and as soon as it appears to be at sufficient distance, a very simple and efficacious mechanical apparatus is used to destroy its poise, causing it to fall immediately, but remaining still attached by the line, and moored by a small anchor, with which it is equipped. The result of the experiments which I have made with a kite of sixty feet of surface, has been, in a strong breeze, the extension of line weighing sixty pounds, and measuring three hundred and fifty yards in length, and one inch and three quarters in circumference; and at another time the extension of a line weighing thirty-seven pounds, and measuring eleven hundred yards in length, and five-eighths of an inch in circumference.

Being





Being aware, as well from public documents, as from my own experience, of the value of expedients for the purpose in question, I am desirous of giving publicity to mine through the medium of the Society of Arts. I am prepared to exhibit the detail of the apparatus, and to illustrate its application by experiment, and if the Society of Arts shall think it worth their while to obtain a report upon it, and that report be such as to render it worth their acceptance, a pattern of it, with the necessary drawings and description shall be at their service.

The kite, Figs. 1 and 2 (Plate XV.) is a sheet of Holland, exactly nine feet square, extended by two spars, the standard, *a a*, placed diagonally, and the cross-piece *b b* at right angles across it, and intersecting two sides of the square at two-thirds from the angle to which one end of the diagonal spar is fixed; by this means that part of the surface of the square which is extended by the spars, forms a figure of about fifty-five square feet of surface, composed of two triangles, one right-angled and one isosceles, which is a very convenient shape for a kite; and the part of the square not extended operates as wings, *c c*, to steady it in its flight. At two points on the diagonal spar, about one-seventh of its length from the head, and the same from the bottom, two lines are attached, the upper about one-sixth of the length of the kite, and the lower two-thirds of its length, which, combined, form the belly-band *g g*, Fig. 2; and the line which is to retain the kite, is attached to the point of their junction with each other *k*, as seen in the Plate. Also, when the kite is large, and there is much wind, as many intermediate lines as may be thought necessary to strengthen the spar

spar may be added. The tail may be five or six times the length of the kite, and its weight must be proportionate to the wind; but if its bulk be much diffused, and so arranged as to admit of the uniform and constant action of the wind upon it, it will be displaced from that position which is most favourable for steadying the kite; and if much concentrated, it will acquire a violent vibrating motion, equally destructive of its function. The best appears to be one formed of a double cord, whipped at equal intervals with packthread, so as to form a succession of loops or eyes, into which pieces of wood are thrust in order to give the requisite weight, see *ff*, Fig. 2. The kite above described has, in a strong breeze, extended 1100 yards of line five-eighths of an inch in circumference, and would have extended more, had it been at hand. It also extended 360 yards of line one and three-quarters of an inch in circumference, and weighing sixty pounds. The Holland weighed three and a half pounds, the spars, one of which was armed at the head with iron spikes for the purpose of mooring it, six pounds and three-quarters, and the tail was five times its length, composed of eight pounds of rope and fourteen pounds of elm plank, weighing together twenty-two pounds. Thus far, nothing more than the well-known property of the flying kite, and its power, developed to a greater extent perhaps than has often been practised, are involved; and to render that property and power available for the purpose in question, an apparatus has been contrived, which enables those to windward to destroy at will the poise of the kite, and cause its immediate fall, without however detaching it from the line; and those to leeward to restore its poise and effect its immediate ascent.

The apparatus now to be described is that which has
been

been used with a kite of the above-mentioned dimensions. It consists of four parts, which, for the sake of distinction, may be designated the ring, the catch, the striking-bar, and the wedge, forming the apparatus *m*, Fig. 2, and the messenger.

The first is a strong iron ring *o*, of about one and a half inch in diameter, having four cords, eighteen inches or two feet long, fixed at equal distances on its circumference, and all joined together at about three inches from the ring, and attached to the kite (at the extremities of those lines which are to regulate its poise) by the others. The catch, Fig. 4, is made from a piece of tough strong wood, six inches long and one inch in diameter. It has two saw-cuts at right angles to each other through half its length; there is a hole about a quarter of an inch in diameter, beginning in the centre of the end opposite to where the saw-cuts begin, passing about two inches along its axis, and then obliquely to the surface, which it meets at about half an inch below the end of the saw-cuts. Through this hole, the line of the kite *c* passes, and it is fixed in it, within about a fathom of the end which is the side next the saw-cuts, and so that the catch cannot slide either one way or the other. The wedge *p*, Figs. 6 and 7, is about two inches long, it has eight faces, and its transverse section would be a four-pointed star; it is fastened by a cord at its thick end to the cords of the ring where they meet.

To prepare the kite for its ascent, the ring is placed over that end of the catch where the saw-cuts begin (which, it will be observed, have divided it into four equal-sized fangs, whose inside surfaces exhibit eight faces, to correspond to those of the wedge), and the wedge *p* is placed within the fangs or double cleft, which it will extend so that the ring is caught in a groove
which

which goes round the whole circumference of the catch, and cannot be taken off again until the wedge is removed. Therefore it appears, from the manner in which the kite has been described, to be attached to the ring, the ring to the catch, and the catch to the line; that the connection between the line and the kite is complete, but ready to be broken by the removal of the wedge, which would allow the fangs of the catch to contract, and the ring to pass over them and be disengaged. The messenger, shown in section *l*, Fig. 7, is a hollow cylinder, of strong wood, about six inches long, and its interior diameter about an inch and a half, so as to pass freely over the catch, and has a small sail rigged upon it, perpendicular to its axis. When it is required to lower the kite, the line is passed through the cylinder of the messenger, and the wind takes it rapidly up to the kite; when it comes upon the catch it meets with the striking-bar *n* (an edge view of which is represented, Fig. 5), which passes across the small end of the wedge, through one of the saw-cuts, and projects on each side about half an inch beyond its surface. The violence of the shock with which the messenger meets the bar, drives out the wedge, and, by allowing the fangs of the catch to collapse, disengages the ring. The connection with the belly-band is thus broken, and the cord *e* remains attached to the grapnel *d*, the ring and wedge remaining pendant from the belly-band, as *i*, Fig. 1. The centre of suspension being thus transferred to the head of the kite, its rapid descent is the necessary consequence.

In the experiments that have been made with a view of gaining communication with a lee-shore, under the supposition of no assistance being there at hand, a grapnel, *d*, Fig. 1, consisting of four spear-shaped iron spikes, was fixed to the head of the kite so as to moor it on its fall;

fall; and in this emergency, the attempt of some one to get on shore along the line would be the only means to be resorted to. In those cases where maintaining a correspondence after a communication was gained has been the object, the person to windward has attached a weight to the messenger, in some cases as much as three pounds, which having been carried up, has of course descended with the kite; the person to leeward has then furled the sail of the messenger, and loaded it with as much weight as the kite could lift, then replacing the ring and wedge, and exposing the surface of the kite to the direct action of the wind, it has rapidly risen, the messenger running down the line to windward during its ascent. There are a few minute points to be attended to in the construction of this apparatus, which would become so obvious in the progress of preparing it, that it would be useless to add them to a detail, already perhaps too tedious. But it is to be observed that in cases where the wind is not violent enough to take off the kite at once from the deck, or where eddies prevent its impulse from acting fairly and uniformly on its surface, the line of the kite may be passed through a snatch-block, from which another line leads through a block on some high point in the rigging, and it may thus be raised high enough for the wind to take it and clear it of the vessel.

In Fig. 3, *l* is the messenger, which, after it has struck and liberated the belly-band, is itself retained in the represented position by the striking-bar *n*.

Fig. 8, is an end view of the ring, cylinder, and wedge, showing their mutual connexion.



In making use of Captain Dansey's apparatus for establishing a communication between a stranded vessel and
the

the shore, little more attention or skill is requisite than in flying an ordinary kite.

With regard to the construction of the kite, the proportions established by the inventor should be carefully adhered to, particularly in the position of the cross-spar, which if placed too low will prevent the kite from rising well and flying steadily. On the contrary, when the centre of the pressure of the wind upon the surface is as much above the centre of the upright spar, as can be conveniently contrived, without diminishing too much the surface exposed to the wind, the best effect will be produced.

The loose portions of canvas which form the wings, may be removed or not without at all affecting the flying of the kite.

The good effect of the tail in balancing the kite will principally depend on the due proportion of its length and weight to the size of the kite and the strength of the wind.

The length and weight of the tail sufficient in a moderate breeze to keep the kite steady, and to ensure its descent when the messenger has been let off, will be inadequate in a strong wind. The best proportions are to be determined by actual experiment upon each particular kite exposed to a greater or less intensity of wind. In some cases, a single line of ten or twelve times the length of the kite, and of suitable thickness, will succeed perfectly well; in other cases, several smaller lines united at intervals by lashing, with a single piece of board attached to the extremity of the tail, has produced an equally good effect.

In attaching the kite-line to the grapnel, a considerable portion of it should be left to hang loose, in order to prevent any derangement from taking place in the discharging

charging apparatus. It might even be advisable to slip on a smooth metal ring of some weight.

In the apparatus laid before the Society, the inventor has placed the grapnel at the head of the kite, in which situation it performs the office of a galley-anchor, with its shank reversed. The grapnel might, however, be applied, with equal advantage, to the lower extremity of the kite, the points or flukes being still turned upwards. By the latter contrivance, it would perform the office of a similar anchor, with its shank in the usual position.

As the certainty of effecting the communication between the vessel and the shore depends principally on the hold which the grapnel takes in the ground, the communicating line must necessarily be attached to the head of the kite; for if it were attached to the lower extremity the whole apparatus would, in descending, take a rotatory motion, the effects of which would entirely frustrate the success of an operation which should lead to so important a result.

On the Condensation of several Gases into Liquids.

By Mr. FARADAY, Chemical Assistant in the Royal Institution.

From the PHILOSOPHICAL TRANSACTIONS of the
ROYAL SOCIETY of LONDON.

I HAD the honour, a few weeks since, of submitting to the Royal Society a paper on the reduction of chlorine to the liquid state. (*See Repertory, page 332 of the present number.*) An important note was added to the paper by the President, on the general application of the means used in this case to the reduction of other gaseous bodies to the liquid state; and in illustration of the process, the

production of liquid muriatic acid was described. Sir Humphrey Davy did me the honour to request I would continue the experiments, which I have done under his general direction, and the following are some of the results already obtained :

Sulphurous Acid.

Mercury and concentrated sulphuric acid were sealed up in a bent tube, and, being brought to one end, heat was carefully applied, whilst the other end was preserved cool by wet bibulous paper. Sulphurous acid gas was produced where the heat acted, and was condensed by the sulphuric acid above; but, when the latter had become saturated, the sulphurous acid passed to the cold end of the tube, and was condensed into a liquid. When the whole tube was cold, if the sulphurous acid were returned on to the mixture of sulphuric acid and sulphate of mercury, a portion was re-absorbed, but the rest remained on it without mixing.

Liquid sulphurous acid is very limpid and colourless, and highly fluid. Its refractive power, obtained by comparing it in water and other media, with water contained in a similar tube, appeared to be nearly equal to that of water. It does not solidify or become adhesive at a temperature of 0° F. When a tube containing it was opened, the contents did not rush out as with explosion, but a portion of the liquid evaporated rapidly, cooling another portion so much as to leave it in the fluid state at common barometric pressure. It was, however, rapidly dissipated, not producing visible fumes, but producing the odour of pure sulphurous acid, and leaving the tube quite dry. A portion of the vapour of the fluid received over a mercurial bath, and examined, proved to be sulphurous acid

acid gas. A piece of ice dropped into the fluid instantly made it boil, from the heat communicated by it.

To prove in an unexceptionable manner that the fluid was pure sulphurous acid, some sulphurous acid gas was carefully prepared over mercury, and a long tube perfectly dry, and closed at one end, being exhausted, was filled with it; more sulphurous acid was then thrown in by a condensing syringe, till there were three or four atmospheres: the tube remained perfectly clear and dry, but on cooling one end to 0° , the fluid sulphurous acid condensed, and in all its characters was like that prepared by the former process.

A small gauge was attached to a tube in which sulphurous acid was afterwards formed, and at a temperature of 45° F. the pressure within the tube was equal to three atmospheres, there being a portion of liquid sulphurous acid present; but as the common air had not been excluded when the tube was sealed, nearly one atmosphere must be due to its presence, so that sulphurous acid vapour exerts a pressure of about two atmospheres at 45° F. Its specific gravity was nearly 1.42.

I am indebted to Mr. Davies Gilbert, who examined with much attention the results of these experiments, for the suggestion of the means adopted to obtain the specific gravity of some of these fluids. A number of small glass bulbs were blown and hermetically sealed; they were then thrown into alcohol, water, sulphuric acid, or mixtures of these, and when any one was found of the same specific gravity as the fluid in which it was immersed, the specific gravity of the fluid was taken: thus a number of hydrometrical bulbs were obtained; these were introduced into the tubes in which the substances were to be liberated; and, ultimately, the dry liquids obtained, in contact with them. It was then observed whether

whether they floated or not, and a second set of experiments were made with bulbs lighter or heavier as required, until a near approximation was obtained. Many of the tubes burst in the experiments, and in others difficulties occurred from the accidental fouling of the bulb by the contents of the tube. One source of error may be mentioned in addition to those which are obvious, namely, the alteration of the bulk of the bulb by its submission to the pressure required to keep the substance in the fluid state.

Sulphuretted Hydrogen.

A tube being bent, and sealed at the shorter end, strong muriatic acid was poured in through a small funnel, so as nearly to fill the short leg without soiling the long one. A piece of platinum foil was then crumpled up and pushed in, and upon that were put fragments of sulphuret of iron, until the tube was nearly full. In this way action was prevented until the tube was sealed. If it once commences, it is almost impossible to close the tube in a manner sufficiently strong, because of the pressing out of the gas. When closed, the muriatic acid was made to run on to the sulphuret of iron, and then left for a day or two. At the end of that time, much proto-muriate of iron had formed, and on placing the clean end of the tube in a mixture of ice and salt, warming the other end if necessary by a little water, sulphuretted hydrogen in the liquid state distilled over.

The liquid sulphuretted hydrogen was colourless, limpid, and excessively fluid. Ether, when compared with it in similar tubes, appeared tenacious and oily. It did not mix with the rest of the fluid in the tube, which was no doubt saturated, but remained standing on it. When a tube containing it was opened, the liquid immediately
rushed

rushed into vapour; and this being done under water, and the vapour collected and examined, it proved to be sulphuretted hydrogen gas. As the temperature of a tube containing some of it rose from 0° to 45° , part of the fluid rose in vapour, and its bulk diminished; but there was no other change: it did not seem more adhesive at 0° than at 45° . Its refractive power appeared to be rather greater than that of water; it decidedly surpassed that of sulphurous acid. A small gauge being introduced into a tube in which liquid sulphuretted hydrogen was afterwards produced, it was found that the pressure of its vapour was nearly equal to seventeen atmospheres at the temperature of 50° .

The gases used were made by drawing out some tubes at the blow-pipe table until they were capillary, and of a trumpet form; they were graduated by bringing a small portion of mercury successively into their different parts; they were then sealed at the fine end, and a portion of mercury placed in the broad end; and in this state they were placed in the tubes, so that none of the substances used, or produced, could get to the mercury, or pass by it to the inside of the gauge. In estimating the number of atmospheres, one has always been subtracted for the air left in the tube.

The specific gravity of sulphuretted hydrogen appeared to be 0.9.

Carbonic Acid.

The materials used in the production of carbonic acid, were carbonate of ammonia and concentrated sulphuric acid; the manipulation was like that described for sulphuretted hydrogen. Much stronger tubes are, however, required for carbonic acid than for any of the former substances, and there is none which has produced so
held

many or more powerful explosions. Tubes which have held fluid carbonic acid well for two or three weeks together, have upon some increase in the warmth of the weather, spontaneously exploded with great violence; and the precautions of glass masks, goggles, &c. which are at all times necessary in pursuing these experiments, are particularly so with carbonic acid.

Carbonic acid is a limpid colourless body, extremely fluid, and floating upon the other contents of the tube. It distils readily and rapidly at the difference of temperature between 32° and 0° . Its refractive power is much less than that of water. No diminution of temperature to which I have been able to submit it, has altered its appearance. In endeavouring to open the tubes at one end, they have uniformly burst into fragments, with powerful explosions. By inclosing a gauge in a tube in which fluid carbonic acid was afterwards produced, it was found that its vapour exerted a pressure of thirty-six atmospheres at a temperature of 32° .

It may be questioned, perhaps, whether this and other similar fluids obtained from materials containing water, do not contain a portion of that fluid; in as much as its absence has not been proved, as it may be with chlorine, sulphurous acid, cyanogen, and ammonia. But besides the analogy which exists between the latter and the former, it may also be observed in favour of their dryness, that any diminution of temperature causes the deposition of a fluid from the atmosphere, precisely like that previously obtained; and there is no reason for supposing that these various atmospheres, remaining as they do in contact with concentrated sulphuric acid, are not as dry as atmospheres of the same kind would be over sulphuric acid at common pressure.

Euchlorine.

Euchlorine.

Fluid euchlorine was obtained by inclosing chlorate of potash and sulphuric acid in a tube, and leaving them to act on each other for twenty-four hours. In that time there had been much action; the mixture was of a dark reddish brown, and the atmosphere of a bright yellow colour. The mixture was then heated up to 100° , and the unoccupied end of the tube cooled to 0° ; by degrees the mixture lost its dark colour, and a very fluid ethereal-looking substance condensed. It was not miscible with a small portion of the sulphuric acid, which lay beneath it; but when returned on to the mass of salt and acid, it was gradually absorbed, rendering the mixture of a much deeper colour even than itself.

Euchlorine, thus obtained, is a very fluid transparent substance, of a deep yellow colour. A tube, containing a portion of it, in the clean end, was opened at the opposite extremity; there was a rush of euchlorine vapour, but the salt plugged up the aperture: whilst clearing this away, the whole tube burst with a violent explosion, except the small end in a cloth in my hand, where the euchlorine previously lay, but the fluid had all disappeared.

Nitrous Oxyd.

Some nitrate of ammonia, previously made as dry as could be by partial decomposition, by heat in the air, was sealed up in a bent tube, and then heated in one end, the other being preserved cool. By repeating the distillation once or twice in this way, it was found, on after-examination, that very little of the salt remained undecomposed. The process requires care. I have had many explosions occur with very strong tubes, and at considerable risk.

When

When the tube is cooled, it is found to contain two fluids, and a very compressed atmosphere. The heavier fluid, on examination, proved to be water, with a little acid and nitrous oxyd in solution : the other was nitrous oxyd. It appears in a very liquid, limpid, colourless state ; and so volatile, that the warmth of the hand generally makes it disappear in vapour. The application of ice and salt condenses abundance of it into the liquid state again. It boils readily by the difference of temperature between 50° and 0° . It does not appear to have any tendency to solidify at -10° . Its refractive power is very much less than that of water, and less than any fluid that has yet been obtained in these experiments, or than any known fluid. A tube being opened in the air, the nitrous oxyd immediately burst into vapour. Another tube opened under water, and the vapour collected and examined, it proved to be nitrous oxyd gas. A gauge being introduced into a tube, in which liquid nitrous oxyd was afterwards produced, gave the pressure of its vapour as equal to above 50 atmospheres at 45° .

Cyanogen.

Some pure cyanuret of mercury was heated until perfectly dry. A portion was then inclosed in a green glass tube, in the same manner as in former instances, and being collected to one end, was decomposed by heat, whilst the other end was cooled. The cyanogen soon appeared as a liquid : it was limpid, colourless, and very fluid ; not altering its state at the temperature of 0° . Its refractive power is rather less, perhaps, than that of water. A tube containing it being opened in the air, the expansion within did not appear to be very great ; and the liquid passed with comparative slowness into the state of

of vapour, producing great cold. The vapour, being collected over mercury, proved to be pure cyanogen.

A tube was sealed up with cyanuret of mercury at one end, and a drop of water at the other; the fluid cyanogen was then produced in contact with the water. It did not mix, at least in any considerable quantity, with that fluid, but floated on it, being lighter, though apparently not so much so as ether would be. In the course of some days, action had taken place, the water had become black, and changes, probably such as are known to take place in an aqueous solution of cyanogen, occurred. The pressure of the vapour of cyanogen appeared by the gauge to be 3.6 or 3.7 atmospheres, at 45° Fahrenheit. Its specific gravity was nearly 0.9.

Ammonia.

In searching after liquid ammonia, it became necessary, though difficult, to find some dry source of that substance; and I at last resorted to a compound of it, which I had occasion to notice some years since with chloride of silver. When dry chloride of silver is put into ammoniacal gas, as dry as it can be made, it absorbs a large quantity of it; 100 grains condensing above 130 cubical inches of the gas: but the compound, thus formed, is decomposed by a temperature of 100° Fahrenheit, or upwards. A portion of this compound was sealed up in a bent tube, and heated in one leg, whilst the other was cooled by ice or water. The compound thus heated, under pressure, fused at a comparatively low temperature, and boiled up, giving off ammonical gas, which condensed at the opposite end into a liquid.

Liquid ammonia, thus obtained, was colourless, transparent, and very fluid. Its refractive power surpassed

that of any other of the fluids described, and that also of water itself. From the way in which it was obtained, it was evidently as free from water as ammonia in any state could be. When the chloride of silver is allowed to cool, the ammonia immediately returns to it, combining with it, and producing the original compound. During this action a curious combination of effects takes place : as the chloride absorbs the ammonia, heat is produced, the temperature rising up nearly to 100° ; whilst a few inches off, at the opposite end of the tube, considerable cold is produced by the evaporation of the fluid. When the whole is retained at the temperature of 60° , the ammonia boils till it is dissipated and re-combined. The pressure of the vapour of ammonia is equal to about 6.5 atmospheres at 50° . Its specific gravity was 0.76.

Muriatic Acid.

When made from pure muriate of ammonia and sulphuric acid, liquid muriatic acid is obtained colourless, as Sir Humphry Davy had anticipated. Its refractive power is greater than that of nitrous oxyd, but less than that of water ; it is nearly equal to that of carbonic acid. The pressure of its vapour, at the temperature of 50° , is equal to about 40 atmospheres.

Chlorine.

The refractive power of fluid chlorine is rather less than that of water. The pressure of its vapour at 60° is nearly equal to four atmospheres.

Attempts have been made to obtain hydrogen, oxygen, fluoboracic, fluosilicic, and phosphuretted hydrogen gases in the liquid state ; but though all of them have been subjected to great pressure, they have as yet resisted

con-

condensation. The difficulty, with regard to fluoboric gas, consists, probably, in its affinity for sulphuric acid, which, as Dr. Davy has shown, is so great as to raise the sulphuric acid with it in vapour. The experiments will, however, be continued on these and other gases, in the hopes that some of them, at least, will ultimately condense.

Description of a simple, cheap, and accurate Method of experimenting on small Quantities of Gases, by Means of Bent Tubes. By Mr. WILLIAM KERR.

With an Engraving.

From the EDINBURGH PHILOSOPHICAL JOURNAL.

THE greatest obstacles to experimental research that have hitherto presented themselves to young chemists, and even to proficients in the science, are the expense of the requisite apparatus, and the want of room to contain them. This has especially been the case with respect to apparatus for experimenting on gases. These obstacles, it is hoped, the following contrivance will do much to remove.

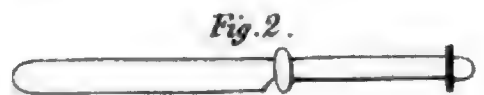
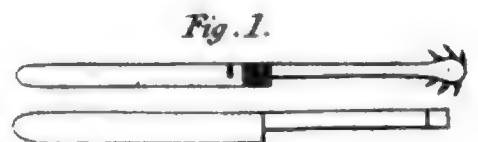
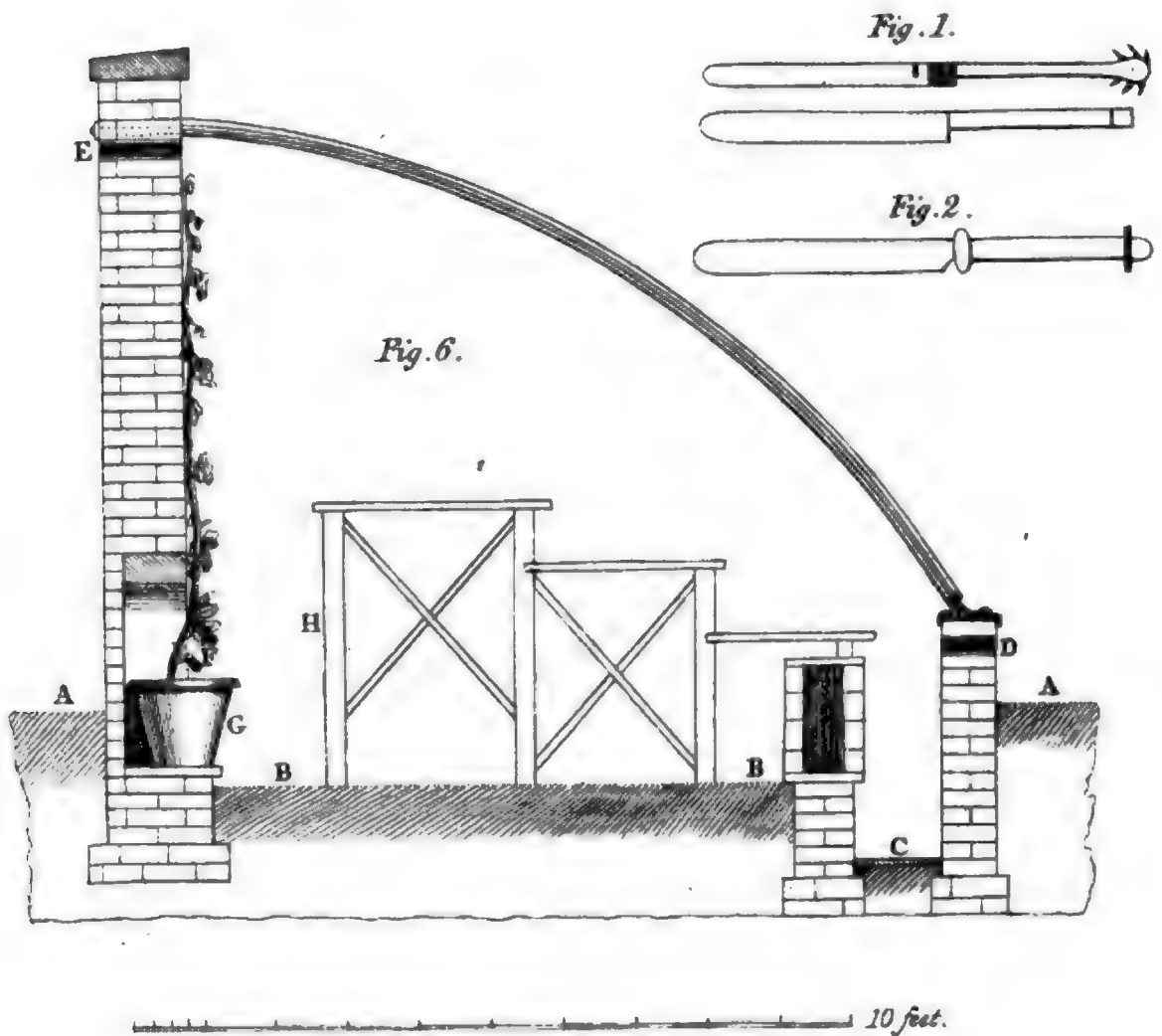
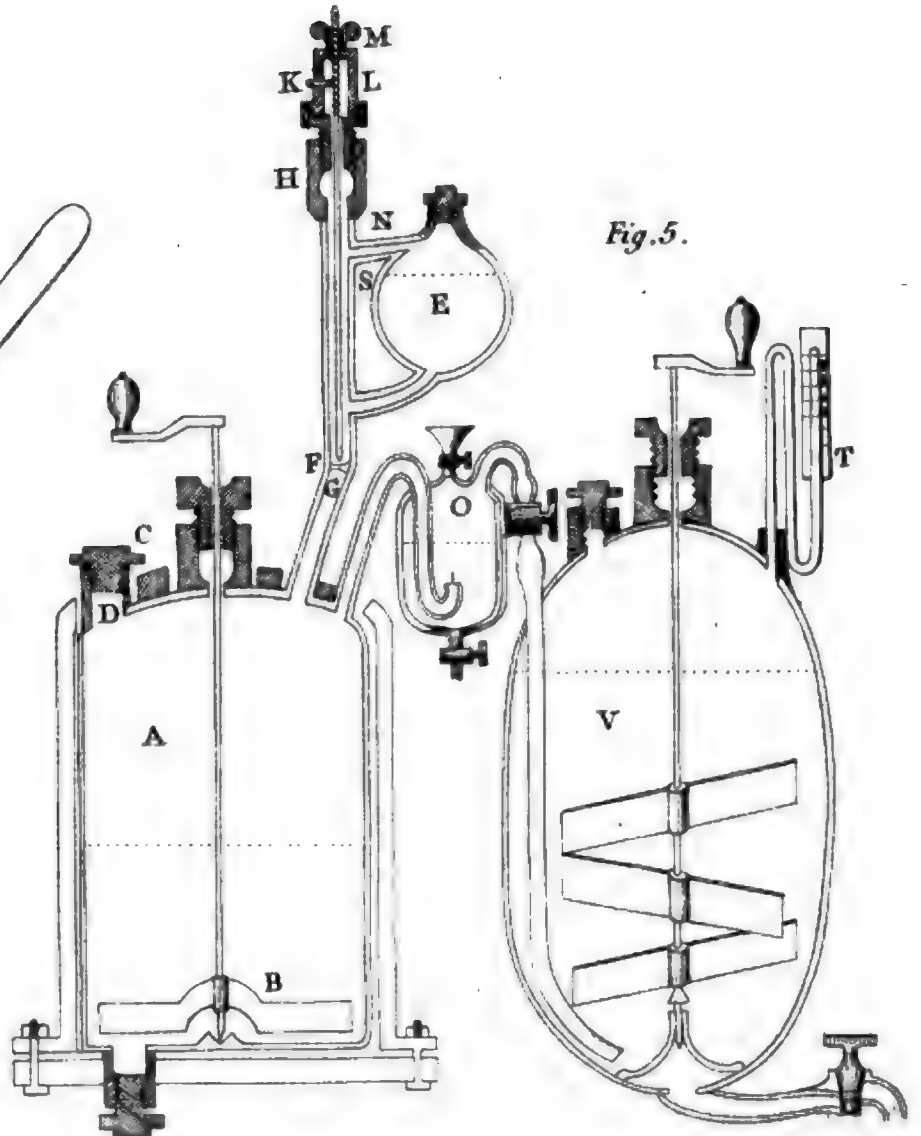
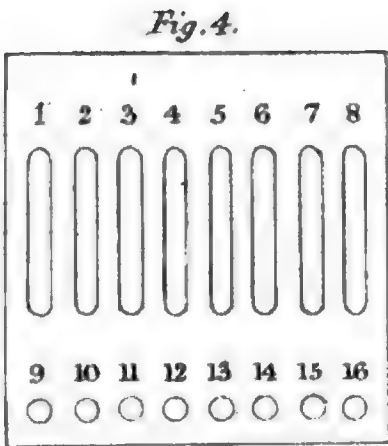
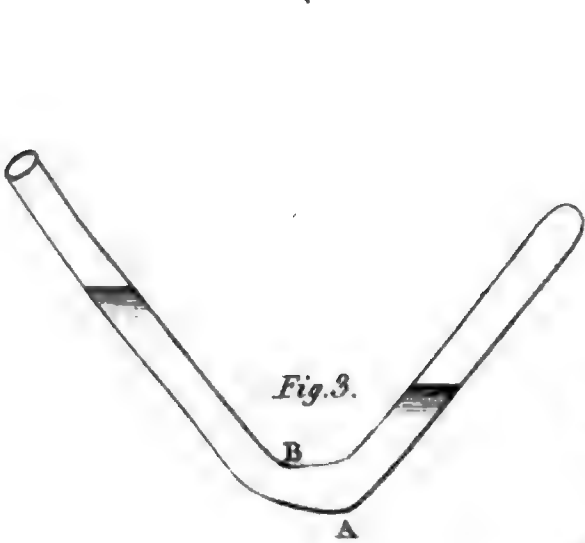
A glass tube from six to twelve inches in length, and from two to five lines wide, so as to be capable of holding from two to six drachms, is to be hermetically shut at one end, and bended a little below its middle, so as to form two branches, of which the shut branch will be somewhat shorter than the other, diverging from each other nearly at a right angle. The vertex of the tube should be widened on the concave side, and this done more toward the shut than the open branch, as is represented in Fig. 3 (Plate XVI.) The vertex A of the convex side of the curvature does not correspond with

with B, that of the concave side, but is beneath the shut branch.

The gas evolved from the mutual action of two bodies, of which at least one is a liquid, may be collected in the shut branch in the following manner. Let the tube be held in the hand by the open end, so that this be the highest, and the shut end the lowest part of the tube; then the liquid is to be poured in till it begins to ascend above the vertex. The shut extremity is now to be elevated as high as the open end, while the vertex is depressed, so as to be the lowest part of the tube. In this position the shut branch will remain full, the liquid within it being supported by the pressure of the atmosphere on the small portion of the fluid, that is above the vertex, in the open branch. If a solid body, of greater specific gravity than the liquid, be now introduced into the open end of the tube, it will fall down to the vertex, and any gas evolved from its surface will rise through the liquid, and be collected in the shut branch, while the liquid will ascend in that which is open. Owing to the vertex of the convex side being beneath the shut branch, while that of the concave is nearer the open one, the whole, or almost the whole of the gas evolved, from any bit of solid matter resting on the most depending part of the curvature, will ascend into the shut branch. In this manner the gas is collected unmixed with common air, and if the experiment requires the application of heat, the bent tube may be placed in a sand-bath; so that by means of such tubes, experiments may be performed on small quantities of gases, not only more economically, but, it is hoped, more accurately than is commonly done on larger quantities, with a more costly apparatus.

A bent tube of the form described, may be also used for discovering the quantity of gas absorbed by a liquid.

For





For example, the quantity of oxygen absorbed from atmospheric air by a solution of the proto-sulphate of iron. The air being confined in the sealed branch, by the solution contained in the open one, will be exposed to the pressure of the column of liquid; and as the open end may be corked, the solution can absorb no other gas but that contained in the tube. The quantity absorbed may be known by tying, at the commencement of the experiment, a waxed thread around the tube, at the boundary of the air and liquid.

Other gases may be absorbed by other liquids, in nearly the same manner; for instance, carbonic acid by milk of lime; only when any other gas than atmospheric air is introduced into the tube, the whole tube must be previously filled with water. The water in the open branch, with the exception of a small quantity sufficient to confine the gas, is then to be sucked out with a straw or small glass tube, and the milk of lime substituted for it.

A bent tube of a small size answers best for collecting gas; and one of a larger size for the absorption of gases.

If the experiment to be performed requires any considerable time, the curvature of the tube may be passed through a slit made in a thin board, the slit being of such length, that the branches of the tube may rest upon the board at the extremities of the slit. Experiments may be going on, at the same time, in several tubes, placed in as many slits in the same board, which may be made to form part of a very convenient portable frame, for holding a number both of bent tubes for gases, and test tubes for precipitations.

Fig. 4 is the plan of a board which may be made of mahogany, eight inches square, and one-quarter of an inch thick. In it there are eight slits for bent tubes, and

at

at one end it is pierced with eight holes for test tubes. This board forms the top of the frame. Another board of the same dimensions, parallel to the former, forms the sole; and these two boards are connected together at the corners, by four small wooden pillars. The whole frame need not weigh more than eleven ounces. It may be placed on a table or shelf, and may be lifted from one place to another, loaded with all the tubes that it is intended to contain, without disturbing any of the processes going on in these.

The slits and holes should be numbered, and a register kept of the processes going on in each of the tubes, by which they are occupied.

It is hoped that bent tubes will be found useful to students at universities, to travellers, and to those who cannot carry large, brittle, and expensive apparatus along with them.

To those who have not the means of purchasing expensive chemical apparatus, the bent tubes will recommend themselves by their cheapness; each of them superseding, for small experiments, a retort, a pneumatic trough, and a receiver.

In the laboratory of the chemist they will also be useful, by enabling him to perform experiments, in the small space of eight or nine inches square, which would have otherwise required eight or nine retorts, and as many receivers.

An addition may be made to these tubes, by which the quality of the gas evolved at any period of the experiment may be examined, without disturbing the process going on.

Description

Description of a New Power, and Apparatus for impregnating Mineral Waters with Carbonic Acid.

By Mr. CHARLES CAMERON, Chemist, Glasgow.

With an Engraving.

From the EDINBURGH PHILOSOPHICAL JOURNAL.

THE vessel A, Fig. 5 (Plate XVI.) containing about fifteen gallons, is formed of cast-iron, six-eighths of an inch thick, and lined with sheet-lead of from eight to ten pounds per square foot, having an agitator B covered with lead, working on the pivot below and through the stuffing-box C. By the opening at D the vessel is filled up to the dotted line with a mixture of whitening and water. The vessel E, containing two gallons, is formed of lead, six-eighths of an inch thick, and is filled with sulphuric acid up to the dotted line. The acid is kept from falling down into A by the lead-plug F, which is conically pointed, and fits into a corresponding conical opening in the lead-pipe G. The plug moves straight up and down through the stuffing-box H, and is prevented from turning round by the pin K, which moves in a slit in the bridle L, the screw-nut M being rivetted loose into the top of the bridle. By this means the conical point of the plug is preserved from injury, as it is merely lifted out of the opening and again pushed into it. This is more complicated than a common formed glass or lead stop-cock, but neither of them will answer where a high pressure is applied. The pipe N, inserted into the top of the vessel E, and into the pipe S (which incloses the plug), preserves the equilibrium of pressure, so that the sulphuric acid rises no higher in the pipe S than in E, and consequently preserves the brass-work of the

the stuffing-box. The intermediate vessel O, containing three gallons, is formed of thick lead, or cast-iron lined with lead, and filled with water up to the dotted line; it is employed for retaining any of the sulphuric acid, in case it should be carried over by too strong an effervescence. The vessel V, containing sixteen gallons, may be formed either of copper tinned, with an agitator of the same metal, or of cast-iron lined with six or eight pounds of lead, and an agitator of maple-wood, which gives no taste to the water. It is filled to the dotted line with water, and a proportional quantity of carbonate of soda, magnesia, or other substance to be impregnated. T is a pressure-gauge, containing mercury; in the figure it is placed on the top of the vessel, but it is more convenient to place it at a little distance, forming a communication by a pipe. The communicating pipes are lead, and their several uses are distinctly evident in the figure. When the vessels are filled, the mode of operation is extremely simple. On turning the nut M, the sulphuric acid is allowed to come into contact with the whitening; carbonic acid is necessarily disengaged, and in quantity and rapidity proportional to the quantity of sulphuric acid let down.

If the vessels were sufficiently capacious, 10,000 gallons of carbonic acid could be instantaneously produced. But by the alternate turning of the nut M, the sulphuric acid is allowed to fall down in small portions, which regulates the disengagement of the gas, and prevents too great an effervescence. As the gas is still accumulating, having no way to escape, it passes over into the vessel V, and is there absorbed by the water. In this way a pressure from twenty to thirty atmospheres may be thrown into the vessels. It must therefore be obvious to every man of science, that if the vessel A were connected by a pipe,

pipe, with the valves of an engine somewhat similar to a steam-engine, the vast pressure which can be so instantaneously produced would raise and depress alternately the piston of a cylinder; that cylinder, too, would only require to be one-twentieth the diameter of the steam-cylinder to have an equivalent power; and the gas would be reduced to one atmosphere by its alternate escape at the opposite valves, no water being required for condensation. But, unfortunately, the expense of sulphuric acid, from the quantity required (when the gas is allowed to escape), presents an unsurmountable obstacle as a substitute for the steam-engine.

Since I discovered the power, from the production of carbonic acid, and put it into practice four years ago, an account of which was noticed in most of the journals and newspapers of the day, I am happy to observe, that that distinguished ornament of our age, Sir Humphrey Davy, has turned his attention to it, and discovered that the gases, at a high pressure, are powerfully acted upon by slight increments of temperature, and the pressure astonishingly augmented.

This circumstance affords us flattering hopes that an engine, constructed on the principles of the Reverend Mr. Stirling's air-engine, may yet be made to equal, and in many cases to supersede, the steam-engine, by reducing the expenditure of sulphuric acid.

*Upon the Advantages and Disadvantages of curvilinear
Iron Roofs to Hot-houses.*

By THOMAS ANDREW KNIGHT, *Esq. F. R. S. &c.*

With an Engraving.

From the TRANSACTIONS of the LONDON
HORTICULTURAL SOCIETY.

THE Society having more than once expressed a wish to receive from me an account of my opinion of the comparative advantages and disadvantages of the iron curvilinear, and common hot-house roofs of sliding lights, in the culture of the pine apple, as soon as experience should have enabled me to give it, I am now, I believe, in possession of sufficient information to enable me to give an opinion with some degree of confidence, having had the experience of three summers, in which I have nearly sacrificed more than two hundred very fine fruiting pine apple plants in my curvilinear-roofed hot-house. I have, however, ultimately succeeded to the full extent of my hopes and expectations, and I give a decided preference to the curvilinear roof. I must, nevertheless, admit, that it has some defects, which I shall endeavour to point out, and set in opposition to its perfections.

The curvilinear iron roof certainly transmits heat more rapidly than one of wood of the ordinary construction, but not to any considerable extent, I think, more rapidly than a roof composed of wood and glass would do, if the wood were employed in as small quantities as the iron is, and not nearly to as great an extent as a roof composed wholly of glass would do, if such could be constructed.

My house is fifty feet long, and ten feet wide, and it is heated by a single fire, of moderate size; and I have found

found that single fire fully sufficient to keep pine apple plants in a healthy growing state, in all seasons of the year, without the aid of bark or hot-bed of any kind, and without the protection of any kind of covering. A much higher temperature than my machinery enables me to give, and varying from 75° to 90° in winter, and from 80° to 105° in summer, would, however, be highly beneficial: and I feel quite confident, that in a dry stove, of such temperature, pine apples might, under appropriate management, be abundantly ripened, and in considerable perfection, in any part of the year. I have always used this house as a fruiting-house, and my plants, after being placed in it, have grown admirably, and have shown fruit well; but the fruit has never, till the present year, except in one instance, when the plants stood close to the door, swelled properly. Its taste and flavour have, nevertheless, been good, and it constantly ripened in a singularly short time.

The fruit which appeared in September and October, in the last autumn, became ripe in January; and whenever one fruit became ripe, its aroma appeared to accelerate the maturity of all in its vicinity.

The queen pine apples were generally very similar to those I have usually seen at the shops in London in the months of April and May; and with imperfections arising, I believe, from the same source, the want of efficient ventilation.

In houses of ordinary construction, with roofs of sliding lights, air enters and escapes at all times with much rapidity; and the consequent change of air is very nearly, if not wholly, sufficient to enable the pine apple to acquire maturity and perfection at all seasons; provided the flues operate with sufficient power to give the requisite temperature. But in my house, with a curvilinear.

vilinear roof, I acquired the power of almost wholly preventing any change of air whatever, and I exercised that power too extensively, after the fruit was shown, and particularly after a part of it had nearly acquired maturity. In the last spring I adopted a mode of ventilation, from which I expected to derive all the advantages of change of air, without materially lowering the temperature of the house, and the success of it has greatly exceeded the expectations I had entertained. I shall best be able to shew the advantages of this mode of ventilation, by giving a slight sketch of the form of a section of my house, in which D, Fig. 6 (Plate XVI.) marks the position of cylindrical passages of nearly two inches diameter through the front wall. Through these, which are placed eighteen inches distant from each other, along the whole front wall of the house, the air, whenever the weather is warm, is suffered to enter freely, and its entrance is at other times more or less obstructed in proportion to its coldness: but it is never wholly excluded, except during the nights in very severe weather.

The passages through the front wall are placed at just such a distance from the ground as will occasion them to direct the air, which enters either into contact with, or to pass closely over, the heated covers of the flue. It consequently becomes heated, and is impelled amongst the pine-apple plants, which stand in rows behind each other, each row of plants being so far elevated above that before, as to place every plant at nearly an equal distance from the glass roof. A thermometer was placed at H, being equally distant from each end of the house, and I had the satisfaction to observe, that the temperature of that part of the house in which the thermometer stood was raised between two and three degrees, when the external air was at 40°. This effect was, I conclude, produced

duced by the heated air being impelled into the body of the house amongst the plants, instead of being permitted to rise, as it had previously done, and to come instantly into contact with the roof: and by suspending light bodies amongst the plants, I ascertained that the previously confined air was thus constantly kept in a state of rapid motion. The air is suffered to escape through passages of four inches wide, and two inches and a half high, at E, which passages are placed at the same equal distances as those in the front wall, and like those are opened or closed as circumstances require. The trouble of opening or closing such passages, after substances of proper form are prepared and suspended for the purpose, is very small, much less, I think, than that of moving the lights of any house of ordinary construction; and the effect of the kind of ventilation obtained upon the growth of my plants and fruit, is every thing I wish it to be.

I have stated that my whole house is heated by a single flue; this enters at the west-end of it, and thence passes along the whole front within sixteen inches of the wall. It then returns twenty feet towards the middle of the house and back again, the smoke escaping at the end opposite to that at which it enters. The flue is consequently single at the end of the house, which adjoins the fire-place, and triple in the last twenty feet of the opposite end; by which means a nearly equal temperature is every where given.

It has been objected, that the water which drops from bars of iron is extremely noxious to pine-apple plants, but I have not found this to be in any degree the case; for having placed a plant in such a situation that the water from a cast-iron rafter dropped upon it in summer, and removing it only as soon as the mould became sufficiently

ciently moist, I could not discover that the plant had, during a month, sustained the slightest injury. Another objection made to iron roofs is, that the metal is very subject to rust. This is perfectly true, provided they be not kept well painted; but if one-third of the sum requisite to keep a wooden roof properly painted be expended upon the iron roof, no injury will ever be sustained from the liability of that to suffer from rust. I must, however, take this opportunity of observing, that the bars of all the iron roofs I have yet seen have been exceedingly ill formed. The metal, instead of being rolled thin with grooves, and made to descend into the house far below the level of the glass, should be compressed into the least compass consistent with sufficient strength; and its lower surface, instead of being brought to a thin edge, should be hemicylindrical in form. None of the edges or angles which are now presented, and which are most subject to rust, would then exist; less shade would be thrown upon the plants in the mornings and evenings; and the condensed steam would be less subject to drop from the bars upon the plants; though this, in a house constructed as mine is, can never do any injury.

I have remarked in a former communication, that I suspected pine-apple plants might suffer under the influence of a bright sun during the whole length of an English summer's day, in a hot-house with a curvilinear roof such as mine, if the glass were of good quality. I am not prepared positively to say whether such apprehensions are well or ill founded, but I have thought it best to be provided with a net, such as those usually employed to protect fruit-trees, of proper form to cover my house, if necessary; and I am satisfied that I could have used it with advantage, if I had possessed it in some very hot days in the beginning of June.

The

The ends of my house are of brickwork ; but I think the end opposite the door ought to contain a window of about two feet square, to permit a free passage of air through, upon the door being opened in very hot weather : my own house is, however, without one.

In conclusion, I wish to observe, that a curvilinear iron roof may be erected at much less expense than one of wood ; two shillings and sixpence a foot being, I conceive, a fully remunerating price to the builder of such a house as mine, the glass being white, and of the quality called *best seconds*. Green glass might be afforded on much lower terms, but I do not recommend it, being confident that in our climate pine-apple plants suffer a hundred days by want of light, for one in which, with proper care, they sustain injury by excess of it.

REFERENCES TO THE ENGRAVING.

AA, level of the external soil. BB, level of the internal soil. C, level of the front walk, which is sixteen inches wide. D, passages to admit the external air eighteen inches distant from each other, along the whole front wall. E, passages to permit the escape of heated air. F, recesses six feet distant from each other, to receive in part, pots holding vines and fig-trees, or Tropical fruit-trees. G, a pot let half way into the recess. H, the situation of the thermometer.

N. B. The advantages gained by the recesses are, that the stems of the plants intended to be trained against the wall are brought at once close to it, and the back walk in the house is less obstructed by the pots.

On different Alloys of Potassium, and on the Inflammation of Gunpowder under Water. By M. SERULLAS.

From the *ANNALES DE CHIMIE ET DE PHYSIQUE*.

GUNPOWDER may be fired under water by means of an exploding mixture of charcoal with an alloy of antimony, and potassium, which takes fire on the first contact of water, and will instantly communicate it to the powder. This mixture is thus prepared: mix by careful rubbing 100 grammes of tartar-emetic with 3 grammes of lamp-black or common charcoal. Select crucibles holding 75 to 80 grammes, which must not be more than three quarters filled, make the upper edge smooth, and rub the whole inside with charcoal powder, that the charred mixture, when prepared, may not adhere to its sides. Put some of the materials into the crucible, cover it with charcoal powder, lute on the cover and close every opening. Heat it for three hours in a good reverberatory furnace, then set it by for six hours to cool. This time is required to allow the air, which always penetrates more or less into the crucible, to burn the external layer of the fulminating mass, for if it is withdrawn too soon, it always takes fire spontaneously. Then without loss of time enclose the calcined mass, without breaking it up, in a wide mouthed vessel, where it gradually splits into fragments of different size, and in this state will preserve its properties for years.

When the calcination has been well performed, the product is extremely fulminating, so as to detonate with a report like fire-arms by the first contact of water, and without requiring any compression. Instead of tartar-emetic and lamp-black, the following mixture may be used: carbonize cream of tartar by roasting,
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it in an open crucible till it has lost about half its weight; take 75 parts of this charred tartar, 100 parts of regulus of antimony, and 12 of lamp-black, and mix the whole by constant rubbing. Then calcine it in the crucible in the way above described.

With this fulminating substance it is easy to fire gunpowder under water. The experiment was made in the following manner: half an ounce of gunpowder was put into a strong glass tube closed at one end, of which the powder filled about one quarter. A piece of the fulminating alloy of the size of a pea was laid upon the powder. The tube was immediately closed with a cork which had been previously perforated with a small hole, stopped for the present with a little fat lute soft enough to be readily pierced with a sharp pin when required. The tube thus prepared was then sunk in a large vessel of water two or three feet deep, and was confined by weights to the bottom. Then the lute stopping the perforation of the cork was pierced with a steel wire fixed to the end of a long stick, and the moment that the water entered the tube the powder exploded, breaking the tube and throwing out a four pound weight which had fixed it down.

The author then proceeds to describe several triple alloys of potassium and sodium with antimony and other metals.

Triple alloy of potassium, copper, and antimony.—This is prepared by melting together equal parts of carbonized tartar (already described), regulus of antimony, and copper filings. First, rub together the carbonized tartar and antimony; put it into a crucible, cover it with the copper filings previously mixed with a sixth part of antimony to promote its fusion, lute on the cover, and heat the whole for two hours in a furnace that draws well. This

VOL. XLIV.—SECOND SERIES. C c c alloy,

alloy, like that of antimony and copper alone, has a violet tint. It will divide into very thin brilliant plates which flatten a little under the hammer. It is volatile in the fire. Pieces of it thrown upon mercury covered with a little water turn round rapidly.

Alloy of potassium, silver, and antimony.—This is prepared like the preceding alloy: it is more volatile; its colour is a steel grey, and it has much lustre. It is very brittle, and contains much potassium.

Alloy of potassium, iron, and antimony. Put at the bottom of a crucible some iron turnings broken to small fragments, cover it with equal part of carbonized tartar and antimony previously mixed, melt with a very strong heat, and you will have a triple alloy containing much potassium and very brittle. A triple alloy with bismuth may be prepared in a similar manner.

Alloy of potassium and bismuth.—Rub together 60 grammes of carbonized tartar, 120 of bismuth, and one of nitre, inclose the mixture in a crucible covered with lamp-black, close it carefully, and heat it for two hours.

This alloy is very rich in potassium. The smallest fragment gives sparkles when cut with shears. As soon as it is broken it melts and burns, leaving a residue of a greenish oxyd.

If the above alloy is made with 10 or 12 grammes of lamp-black or charcoal instead of the nitre, a pyrophorus is obtained which takes fire by the contact of water, and bursts with small explosions. It may be used for kindling gunpowder under water.

An alloy of potassium and tin is made in the same manner as the preceding, with 100 parts of oxyd of tin, 60 of carbonized tartar and 10 of lamp-black. A double dose of lamp-black gives a pyrophorus.

An alloy of potassium and lead is produced by 100 grammes

grammes of protoxyd of lead, and 60 of carbonized tartar, and an addition of 5 to 6 grammes of lamp-black gives a pyrophorus. M. Serullas remarks in the preparation of these different alloys, that the stratum of charcoal put over them to protect them from the action of the air, though in no way mixed with them, acquires the property of spontaneous inflammation in the air. This he can only attribute to the presence of potassium volatilized during the fusion, and retained by the charcoal. To pursue further the subject of the separation of potassium from its alloys by heat, the following experiment was made: a gun-barrel was cut nearly in halves, the longer end, which was closed by the breech at one extremity, was filled with a mixture of 50 grammes of carbonized tartar, 70 of litharge, and 2 of lamp-black. The barrel was curved slightly at the open extremity, to which was attached the recipient of Gay-Lussac and Thenard for the preparation of potassium. The barrel was then thrust perpendicularly into a furnace up to its junction with the recipient, and gradually heated nearly to the melting-point of the iron by a powerful bellows. The first products that were given out, were, as usual, water, empyreumatic oil, and yellow vapour, all of which were allowed to escape with every appearance of moisture, before the second part of the recipient was luted on. The bent tube of glass, by which the latter is usually elongated, was dipped under a cup of water. After the fire had been kept up for two hours, there was so rapid an evolution of gas, as to carry out with it a great quantity of the distilled matter, and portions of potassium came up from time to time, and burned on the surface of the water in the cup. The heat was continued for two hours longer with great intensity, and was then discontinued, though

though the evolution of gas was still very vigorous, for fear of the barrel (which was not defended by lute) giving way. The apparatus was examined as soon as it was cold. The recipient contained nothing but a few fragments of the matter projected by the torrent of gas. Just at the upper extremity of the barrel was deposited an alloy of potassium and lead, which when thrown on mercury covered with a little water, burned as strongly as pure potassium. The barrel was sawn asunder at about three inches from the end, and shewed in this point and near it a considerable quantity (7 or 8 grammes) of potassium, nearly pure, that had condensed in that spot and lay in plates above the alloy. When removed, it was melted in rectified petroleum to purify it, but a violent action took place, a large part of the potassium was destroyed, and only a few beautiful silver-white globules were preserved. This result may perhaps lead to a method of obtaining a considerable quantity of potassium, through the medium of alloys with the more fusible of the fixed metals. The latter, as M. Vauquelin has observed, facilitate extremely the reduction of potash by charcoal, uniting in the process with as much as a fifth part of the alkaline metal, or even more.

In certain situations the alloy of bismuth and potassium offers an excellent test of the complete desiccation of gas. All that is required is, to pass up a small fragment of the alloy to the gas confined over mercury, when the least moisture will make it turn round.

*Analysis of the Ashes of Vesuvius, fallen Oct. 22, 1822,
on the Terrace of the Consulate Hotel at Naples.*

By M. VAUQUELIN.

From the *ANNALES DE CHIMIE ET DE PHYSIQUE*.

THESE ashes are in very fine dust, probably having existed within the volcano in form of vapour, mingled with the vapour of water or air, but with some larger particles interspersed. Their colour is grey, like wood-ashes, whence, doubtless, they have derived their name. They have no sensible taste.

Some of the ashes, shaken with distilled water occasionally for a week, gave to this fluid, after concentration by boiling down, very decided alkaline properties. Evaporation to dryness left some sulphate of lime and muriate of ammonia.

Before the blow-pipe these ashes melt, but not easily, into a very shining black glass, much resembling obsidian, or the glass of volcanoes.

The ashes, heated without addition, in a retort, give a white sublimate of muriated ammonia.

Mixed with a quarter of its weight of dry chlorate of potash, and heated in a small retort, whose beak was dipped under mercury, thirty grammes of the ash gave twenty cubic centimetres of carbonic acid.

The ash was digested with dilute nitric acid; it swelled, and became gelatinous. After many days of digestion, the acid was diluted, poured off clear, and evaporated by itself in a porcelain cup. It gave a yellowish-white ill-crystallised salt, slightly deliquescent, and of an astringent taste.

Supposing that this salt contained nitrate and sulphate of lime, and other non-deliquescent salts, I added strong alcohol, which dissolved one portion, and left another untouched.

untouched. In the latter I found nitrate of potash and sulphate of lime; in the former, the alcohol, which was somewhat watery, had retained, as I conjectured, a portion of the nitrate of potash. I therefore first precipitated the alumine and iron by ammonia, then evaporated the liquid, and, when dry, calcined it strongly, to decompose the nitrate and oxalate of ammonia. An alkaline residue remained, which, on saturation with nitric acid, gave nitrate of potash. It is, therefore, evident, that the ashes of Vesuvius contain a sensible quantity of potash. This alkali is evidently combined in the ash with silex and alumine, otherwise it would have been dissolved by mere digestion with water. Besides, this combination is also proved by the gelatinous state produced on digestion with nitric acid.

I proceeded by the usual and well-known methods, which it is needless here to enumerate, to separate the silex, alumine, and oxyd of iron, which are the three most abundant ingredients of the ash. The former composes about 55 *per cent.* the alumine 15, and the oxyd of iron 16; but I did not think it worth while to ascertain the proportions with more exactness, as probably, they vary considerably at different periods of eruption.

I also found some slight traces of copper and manganese, but neither gold, nor copper, nor antimony.

List of Patents for Inventions, &c.

(Continued from Page 320.)

CHARLES DEMENY, of Paris, France, but now residing in Fenchurch-street, London, Merchant; for an apparatus, containing within itself the means of producing gas from oil and other oleaginous substances, of burning

burning such gas for the purpose of affording light, and of re-placing the gas consumed. Communicated to him by a certain foreigner residing abroad. Dated March 22, 1824.

NAMEN GOODSEL, late of New York, America, but now at 13, Leigh-street, Burton-crescent, Middlesex, Engineer; for a certain machine, or piece of machinery, for breaking, scutching, and preparing flax and hemp for use, upon an improved method, and threshing out the seed thereof, and which is applicable to the threshing of any other kind of grain, and also for shelling clover and other seeds. Dated March 25, 1824.

EDWARD JORDAN, of Norwich, Engineer; for an improvement or improvements in the form or construction of water-closets, or of the apparatus connected therewith. Dated March 27, 1824.

JOSEPH SPENCER, of Belper, Derbyshire, Nail-manufacturer; for certain improvements in the construction of furnaces or forges, for the preparation of iron or steel, and for the process of manufacturing of nails and other articles from the said materials. Dated April 7, 1824.

JONATHAN SCHOFIELD, of Rastrick, Halifax, Yorkshire, Manufacturer; for certain improvements in the manufacture of cloth or fabrick, which he denominates British Cashmere. Dated April 7, 1824.

THOMAS RYALLS, of Sheffield, Yorkshire, Warehouseman; for an apparatus for shaving, which he denominates the useful and elegant facilitator. Dated April 8, 1824.

SAMUEL HALL, of Basford, Nottinghamshire, Cotton-manufacturer; for an improved steam-engine. Dated April 8, 1824.

JAMES TULLOCH, of Savage-gardens, London, Gentleman; for an improvement or improvements in the machinery

chinery to be employed for sawing and grooving marble and other stone, or in producing grooves or mouldings thereon. Dated April 12, 1824.

HENRY POTTER BURT, of Devizes, Wiltshire, Ironmonger; for an improvement in the construction of cranks, such as are used for bells and other purposes. Dated April 14, 1824.

WILLIAM BY, of Joy Cottage, Ivory-place, Brighton, Sussex, Stationer and Bookseller; for a method or apparatus for the preservation or protection of books and covers. Dated April 14, 1824.

JOHN GUNBY, of New Kent-road, Surrey, Sword and Gun-manufacturer; for an improvement in the process of manufacturing of cases for knives, scissars, and other articles. Dated April 14, 1824.

DAVID GORDON, of Basinghall-street, London, Esq.; for certain improvements in the construction of portable gas lamps. Dated April 14, 1824.

JOHN BURN, of Manchester, Lancashire, Dealer in Cotton-twist and west, and general Commission Agent for manufactured goods; for a new apparatus for dressing various kinds of cotton, flaxen, woollen, or silk manufactures. Dated April 14, 1824.

THOMAS GETTIEN, of Henry-street, Pentonville, Middlesex, Gentleman; for improvements in the machinery and process of making metallic rollers, pipes, cylinders, and certain other articles. Dated April 15, 1824.

DANIEL TONGE, of Liverpool, Lancashire, Shipowner; for an apparatus, by means of which an improved method of reefing sails is effected. Dated April 15, 1824.

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